TOWNSHIP OF WELLINGTON NORTH

MOUNT FOREST
SANITARY AND WATER SERVICING

TECHNICAL UPDATE

TOWNSHIP OF WELLINGTON NORTH

MOUNT FOREST
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TECHNICAL UPDATE

January 6, 2021

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File No. 20013

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TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST
SANITARY AND WATER SERVICING TECHNICAL UPDATE

1.0 INTRODUCTION AND BACKGROUND

1.1 Background

A Mount Forest Water Supply and Sanitary Sewage Collection Master Plan study was completed in 2003, which focussed on water storage, trunk watermain and trunk sanitary sewer servicing extensions to undeveloped growth areas within the urban boundaries, and to servicing potential expansions of the urban boundaries and/or servicing adjacent municipal industrial lands. The results of this study are summarized in a document entitled "Township of Wellington North, Class Environmental Assessment for a Water Supply and Sanitary Sewage Collection Master Plan, Community of Mount Forest," December 2003.

A Municipal Class EA for Servicing the South End Development Area, Community of Mount Forest, Project File document, July 27, 2004, summarizes the results of a study completed for Phase 1 municipal servicing of future development lands within the urban boundary south of the South Saugeen River. Those Phase 1 works included a forcemain, watermain and electrical conduits across the South Saugeen River, which were constructed in 2005.

A Class Environmental Assessment (Class EA) for Improvements to the Sanitary Sewage Collection System, Community of Mount Forest, Project File document, Rev. January 28, 2009, summarizes the results of a study completed for key sewage pumping station (SPS) facilities within the community. This study documented evaluations and public consultation for the replacement and expansion of the Cork Street SPS, the replacement and expansion of the Durham Street SPS, and the creation of a new South Water Street SPS for unserviced lands within the urban boundary south of the South Saugeen River. The recommended Cork Street SPS and Durham Street SPS facilities have since been constructed. The South Water Street SPS is designed, and it has been submitted to the Ministry of the Environment, Conservation and Parks (MECP) in May 2020 for approvals.

A Servicing Master Plan Update report was completed in 2010-2011, in order to review and update the recommendations of the 2003 study report, due to the completion of several of the key works identified in the 2003 report, and to update the servicing recommendations based on updated projections of growth patterns and anticipated priorities.

The rate of residential development within Mount Forest has grown considerably since the last study was completed, and it is anticipated to grow significantly for the foreseeable future.

1.2 Purpose of Study

The purpose of this report is to provide a technical update of water and sanitary sewage servicing requirements for future anticipated significant growth within the urban boundary of Mount Forest, and to consider potential servicing to West Grey's industrial park. Known existing sanitary sewer deficiencies are identified in general terms only. Through updated modeling work, existing water distribution system deficiencies are also identified. Generally, the following system components were evaluated as part of this study:

- Water supply capacity.
- Water storage capacity and alternative locations for expanded capacity.
- Water distribution system, based on a previous model updated with current information and based on elevated storage alternatives that were evaluated.
- SPS capacities.
- Sanitary sewage collection system, based on a general knowledge of the system (no model; no detailed evaluation of existing serviced area collection system).

This study does not include an evaluation of the following:

- Growth forecasting (basing growth projections on available studies completed by others)
- Well supply quality and treatment.
- Water distribution system quality.
- Infiltration & inflow issues within the sanitary sewage collection system (general comments only provided).
- Waste water treatment plant.

This study also did not follow the Class Environmental Assessment. Therefore, some of the recommended Activities will require the completion of the appropriate level of Class EA study work, including public and government agency consultation, prior to their implementation (detailed design, approvals, and construction).

1.3 Study Location and Service Area

The community of Mount Forest is located at the northern limit of Wellington County. Mount Forest is intersected by Provincial Highways No. 6 and No. 89 and is bisected by the South Saugeen River which flows generally from east to west through the southern portion of the community. In 1999, a portion of the former Township of Egremont at the northerly end of

Mount Forest, on the east side of Highway No. 6, was annexed into the Mount Forest urban boundary. Those privately owned lands are currently designated for future industrial development. In the past, the Township has had discussions with the Township of West Grey (now part of the Municipality of West Grey), for annexation of lands along what would be a future extension of Coral Lea Drive, west of Nor-Park Drive. Further, there have been past discussions with West Grey for the provision of municipal servicing (sanitary and water) to their Nor-Park Drive industrial area.

Figure 1.1 illustrates the general location of the Township of Wellington North and the community of Mount Forest.

Figure 1.2 illustrates the urban boundaries of the community of Mount Forest and the Official Plan designations of the various areas of the community.

1.4 Existing Servicing

Mount Forest is currently serviced by a municipal Drinking Water System. This system is comprised of four drilled bedrock well supplies, a 2,080 m^3 elevated water storage standpipe complete with a booster pumping station (i.e. 2,000 m^3 effective storage), and a water distribution network. Some areas within the urban boundary are serviced by individual well supplies (e.g. parts of the community that are south of the South Saugeen River).

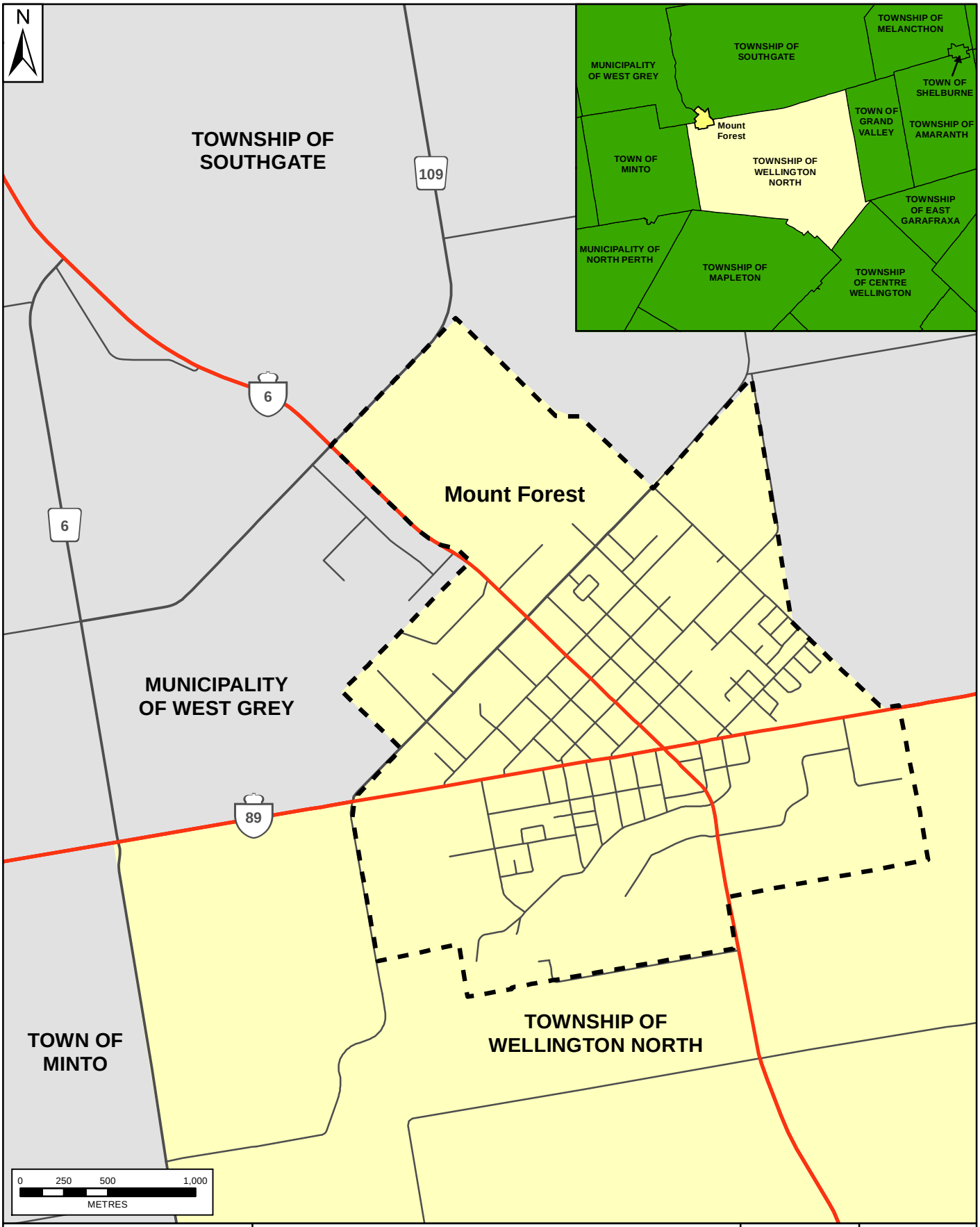
The sanitary sewage system consists of a network of collection sewers, four SPSs, and an extended aeration waste water treatment plant (WWTP), with discharge to the South Saugeen River. Some areas are serviced by low pressure sanitary collection sewers (e.g. private grinder pumps), or by private SPSs (e.g. Victoria Street industrial plaza; OPP Station). Some areas within the urban boundary are serviced by individual Class IV sewage disposal (septic) systems (e.g. area south of the South Saugeen River).

Water and Sanitary Works, as constructed since the last study, have included:

- Albert Street 250mm dia. trunk watermain extension, from 180m west of London Road to London Road.
- Replacement of the Cork Street SPS.
- Replacement of the Durham Street SPS.
- Main Street sanitary sewer replacement, from Queen Street to Miller Street.
- Main Street trunk 300mm dia. watermain, from Queen Street to Miller Street.
- Main Street trunk 250mm dia. watermain extension, from South Water/Murphy Street to approximately 220m south of South Water/Murphy Street.
- Fergus Street sanitary sewer and watermain replacement, from Queen Street to King Street.
- London Road sanitary sewer and watermain extension, from Wellington Street to Broomer Crescent.
- Broomer Crescent sanitary sewer and watermain, from London Road to 53m west of London Road.

- Waterloo Street sanitary sewer, Cork Street SPS forcemain, and watermain replacement, from Cork Street to Dublin Street
- Sanitary sewer and watermain for the Albert Street Estates subdivision (Ruby's Crescent)
- Miller Street sanitary sewer replacement.
- John Street sanitary sewer and watermain replacement, Waterloo Street to Miller Street.
- John Street sanitary sewer replacement, from Miller Street to North Water Street.
- North Water Street sanitary sewer replacement, from John Street to James Street.
- 300mm dia. trunk watermain on Main Street (Grant Street to Miller Street), Miller Street, John Street (Miller Street to North Water Street), and on North Water Street (John Street to James Street), with connection to the existing 300mm dia. trunk main South Saugeen River crossing at James Street.
- Sanitary sewer and watermain for the Lucas Subdivision (Ronnie's Way, Doug's Court, and extension of Sarah Road).
- James Street sanitary sewer and watermain replacement, from Queen Street to North Water Street
- Durham Street watermain extension, Henry Street to Queen Street.
- King Street sanitary sewer and watermain replacement, from Queen Street to Main Street.
- Elgin Street sanitary sewer and watermain replacement, from Wellington Street to King Street.
- Dublin Street watermain replacement, south of Princess Street.
- William Street sanitary sewer extension and watermain replacement, Waterloo Street to North Water Street.
- William Street sanitary sewer and watermain replacement, Queen Street to Waterloo Street.
- Wellington Street East low pressure sanitary sewer extension, east of London Road and towards easterly urban boundary, to service a number of single-family residential severances.
- Durham Street East watermain extension, from London Road to west of London Road
- London Road 250mm dia. trunk watermain, from Durham Street to unopened Birmingham Street road allowance.
- Durham Street East low pressure sanitary sewer, at the easterly end of Durham Street East and west of London Road, to service a 10-unit townhouse development.

The locations of the key municipal water and sewage facilities are presented in Figure 1.3.



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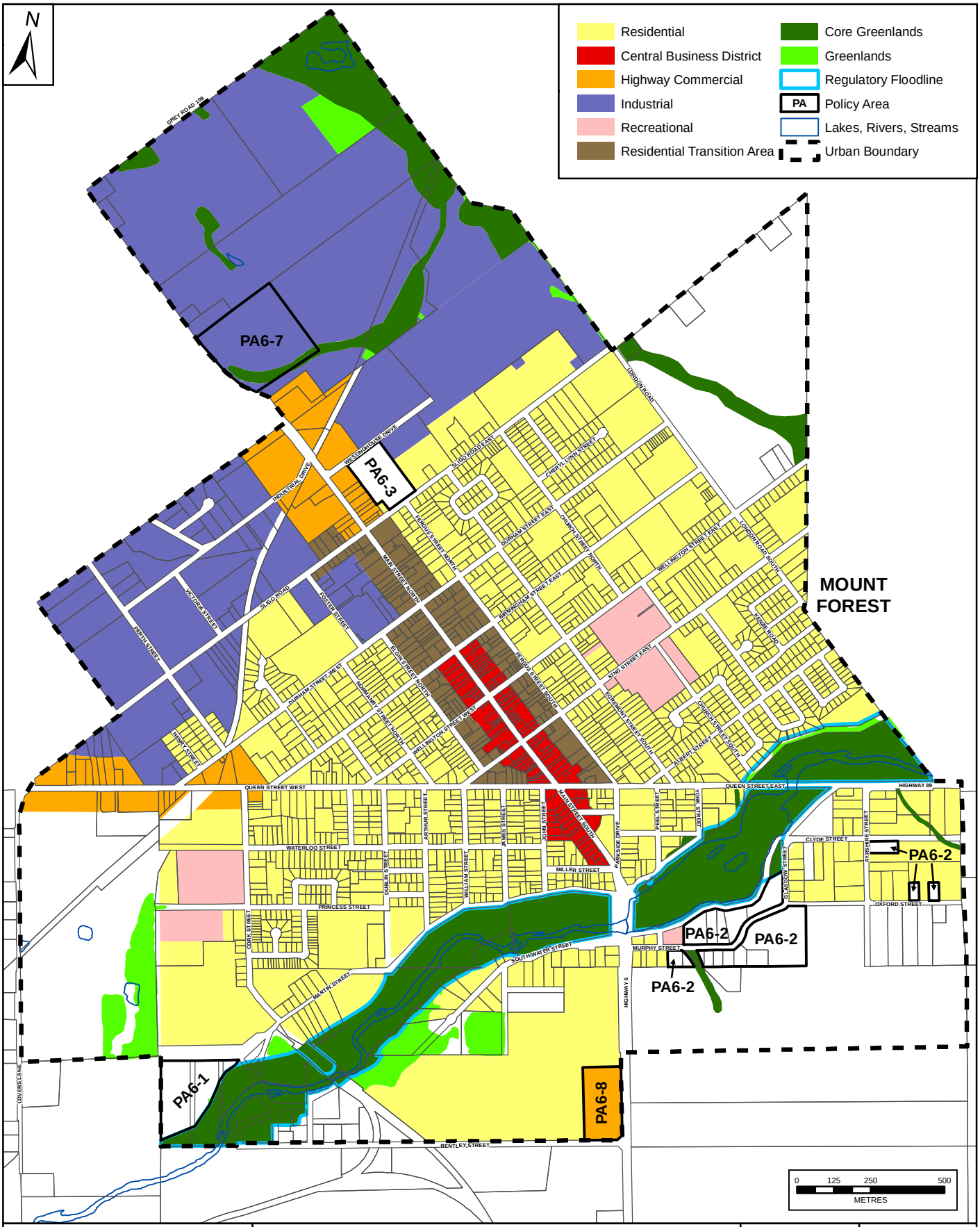
MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

GENERAL LOCATION PLAN

DATE	PROJECT No.
SEPT. 09, 2020	20013
SCALE	FIGURE No.
AS SHOWN	1.1



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SANITARY AND WATER SERVICING TECHNICAL UPDATE

OFFICIAL PLAN DESIGNATIONS

DATE	PROJECT No.
SEPT. 09, 2020	20013
SCALE	FIGURE No.
AS SHOWN	1.2

Durham St
SPS
130 L/s

Well #5
45.5 L/s (32.2)

Well #6
45.5 L/s (32.7)

Perth St
SPS
3.3 L/s

Well #4
22.7 L/s (19.1)

Cork St
SPS
67 L/s

Standpipe
2,000m³

Well 3
22.7 L/s (17.9)

Booster
Pumping Station
215 L/s @ 30m TDH

North Water
St SPS
(NWS-SPS)
173.6 L/s

Wastewater
Treatment
Plant
2,818m³/d

Legend

22.7 L/s (17.9)

Approved and Equipped Capacity

Operational Capacity (i.e. throttled by VFD)

N

0 250 500 1,000
METRES

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MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

EXISTING WATER AND SANITARY FACILITIES

DATE	PROJECT No.
DEC. 11, 2020	20013
SCALE	FIGURE No.
AS SHOWN	1.3

2.0 GIS MAPPING

A significant component of this study was to review and update the Township's GIS data base for the water distribution system and the sanitary collection system. This included preparation of the Exhibit No. 1 and Exhibit No. 2 posters included at the back of this report. GIS shape files were submitted to the Township for uploading into their GIS data base.

3.0 POPULATION & GROWTH

Growth forecasting was not part of this study. Reliance was made on the February 2018 Wellington North Community Growth Plan (Growth Plan) population forecasts. That document projected the following, for Mount Forest:

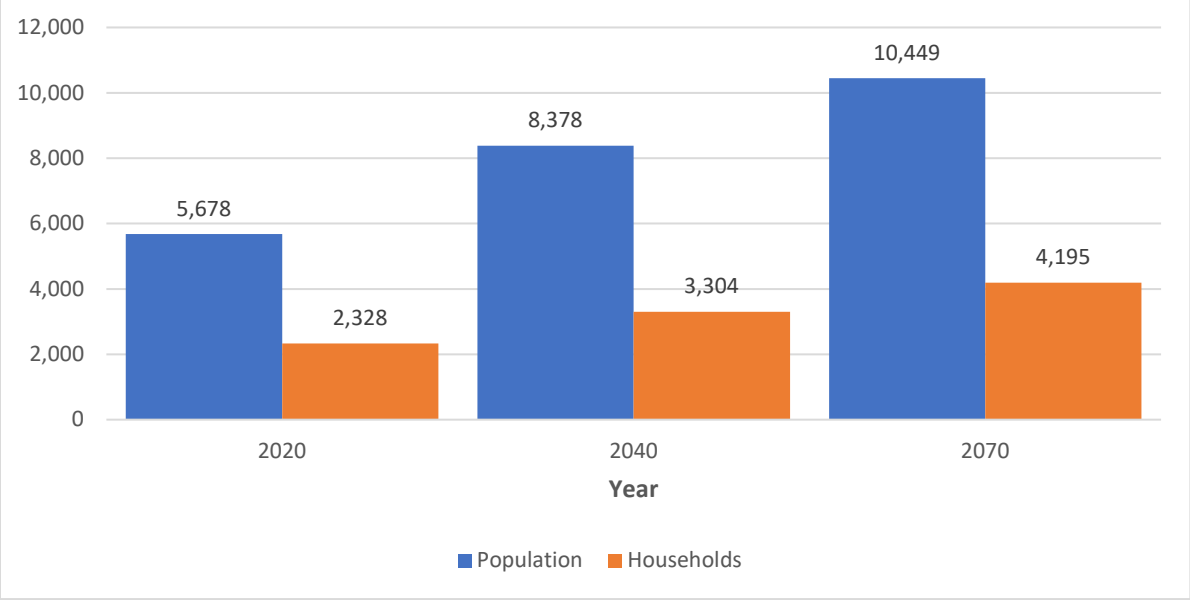
Table 3.1
Population Growth Forecast

Year	Population	Annual Growth	Households	Annual Growth	Capita/Unit
2016	5,190		2,150		2.41
2036	8,135	2.27%	3,200	2.01%	2.54
2041	8,440	0.74%	3,330	0.80%	2.53

Source: Wellington North Community Growth Plan - Final Report - Table 3

This Technical Update study utilized the above and assumed a continued long-term (2041 to 2070) sustained growth rate of 0.74%. The following chart summarizes the calculated population and household projections, for Mount Forest:

Figure 3.1
Population Growth Forecast



This report is based on the following planning periods and the key municipal works that were evaluated within those planning windows.

Table 3.2
Planning Periods

Planning period	Year	Population	Infrastructure evaluation
Current	2020	5,678	Base year conditions and needs
20-year	2040	8,378	Water (well) supply. SPSs (e.g. mechanical – pumps) Costing of such works
50-year	2070	10,499	Water storage Water distribution Sanitary collection Costing of such works

It is assumed that industrial, commercial, and institutional (ICI) growth will match the residential growth rate, in terms of increases to community water demands and sanitary sewage flows.

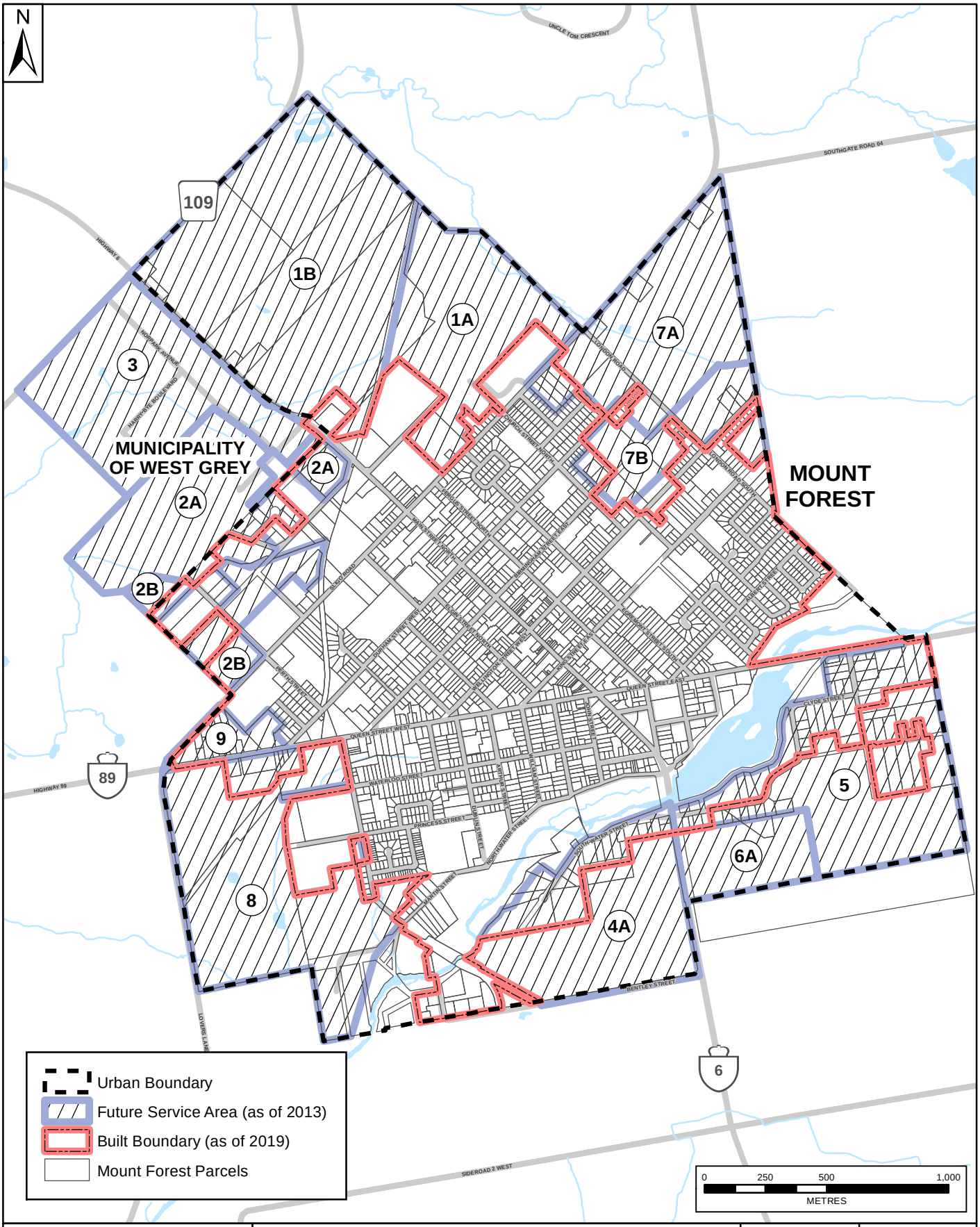
Previous servicing studies identified a number of future service areas for the community, as depicted in Figure 3.1. The Township decided to remove, from this current servicing study, the previous future service areas 4B and 6B, because they are located beyond the south urban boundaries and would require an extension to the urban boundary and there are no current known development interests beyond the south urban boundary. The built serviced area has expanded into some of the future development areas since the time the previous study was completed in 2013.

Since the last servicing study was completed, in 2013, a Growth Plan study was completed and it provides a comprehensive inventory of vacant lands (as of the end of 2017), as follows:

Map 5 – Residential Inventory – Vacant Lands
Map 7 – Non-residential Inventory – Vacant Lands

These maps are included as Appendix A. As can be seen in these maps, atypical for an urban community, the main growth areas are located around the outskirts of the built area, other than opportunity for intensification/infill within the built boundary. The Growth Plan recommends that development be phased to align with planning for infrastructure (Recommendation #2, 4.). The Plan included a map showing four Development Stages, as also included in Appendix A, as follows:

Stage 1 = Current serviced area, focusing on intensification
Stage 2 = Expanding servicing to areas around the perimeter of the current serviced area
Stage 3 = Egremont annexation area (industrial)
Stage 4 = Servicing outer perimeter areas of the urban area.



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SANITARY AND WATER SERVICING TECHNICAL UPDATE

FUTURE SERVICE AREAS

DATE	PROJECT No.
SEPT. 09, 2020	20013
SCALE	FIGURE No.
AS SHOWN	3.2

This Technical Update study focussed on municipal sanitary and water infrastructure to service growth (Stages 2, 3 & 4), with a focus on the probable 20-year growth areas (Stages 2 & 3), as well as consideration for any key works required to continue servicing the existing serviced built area (Stage 1).

The current Wellington County Official Plan greenfield density target is 40 residents per hectare, and this has been assumed for this Technical Update study. It is noted that this target value may increase at the time a future Official Plan is prepared (required by 2022).

Active and current development interests are included in Appendix A, based on a September 2020 report prepared by the Township.

4.0 DRINKING WATER SYSTEM

4.1 Water Demands

Well pumpage records for the past five years were reviewed. Water demands are summarized, as follows:

Table 4.1
Average Day and Maximum Day Well Pumpage Rates (2015-2019)

Month	Average Day Flow (m^3/day)						
	2015	2016	2017	2018	2019	3 yr	5 yr
January	1,304	1,249	1,299	1,390	1,299	1,329	1,308
February	1,381	1,307	1,270	1,312	1,412	1,331	1,336
March	2,177	1,291	1,295	1,321	1,292	1,303	1,475
April	1,507	1,328	1,292	1,316	1,303	1,304	1,349
May	1,515	1,410	1,303	1,415	1,337	1,352	1,396
June	1,454	1,677	1,404	1,540	1,540	1,495	1,523
July	1,613	1,687	1,389	1,676	1,825	1,630	1,638
August	1,447	1,673	1,370	1,386	1,655	1,470	1,506
September	1,397	1,456	1,317	1,401	1,427	1,382	1,400
October	1,307	1,393	1,321	1,378	1,394	1,364	1,359
November	1,272	1,323	1,264	1,323	1,286	1,291	1,293
December	1,248	1,297	1,327	1,315	1,266	1,303	1,291
Annual Average	1,470	1,425	1,320	1,398	1,420	1,380	1,407
Max Day	2,685	2,299	1,797	2,168	2,447	2,447	2,685
Max Day Factor	1.8	1.6	1.4	1.6	1.7	1.8	1.9

The per capita water use calculations are summarized as follows:

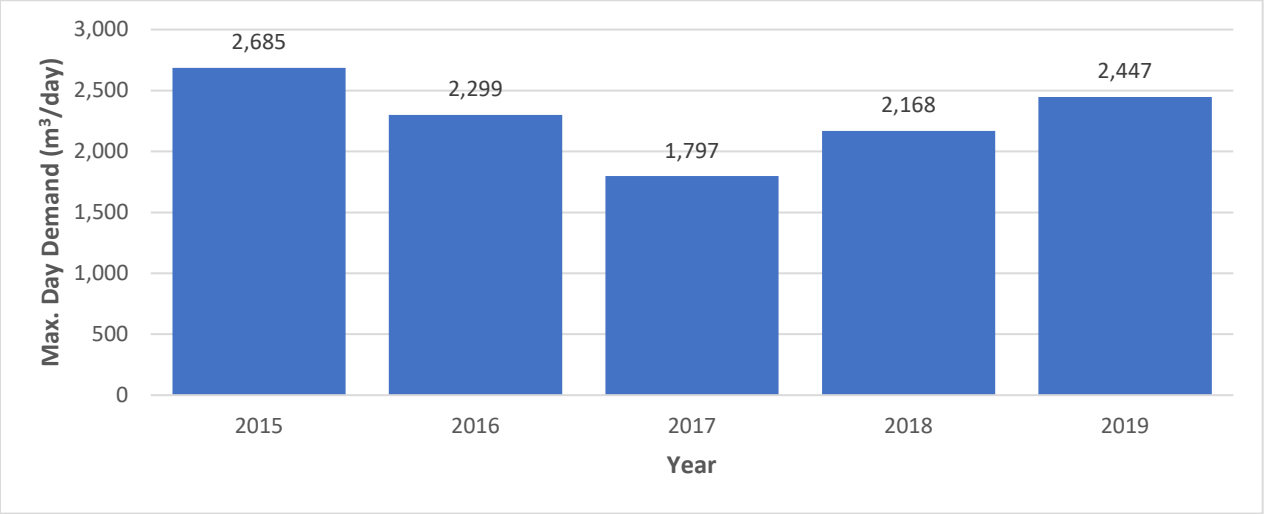
Table 4.2
Per capita Average Day Demand (2013-2019)

Average annual water use summary	2013	2014	2015	2016	2017	2018	2019	3-yr	5-yr
Avg. Day (m^3/day)	1,398	N.A.	1,470	1,425	1,320	1,398	1,420	1380	1407
Population	4,852	4,962	5,075	5,190	5,308	5,429	5,552		
Per capita (Lpcd)	288	N.A.	290	275	249	258	256	254	265

Therefore, based on the 3-year average water use and the populations calculated using the Growth Plan, the current per capita average day water use rate is 254 L/day (i.e. Lpcd). MECP design guidelines recommend a value of 270-450 Lpcd. Because not all of the community is serviced by the Township's Municipal Drinking Water System (i.e. serviced population is less than the Growth Plan population, so the actual per capita water use rate would be higher than the above calculation), and to take into account MECP Guidelines, a design value of 275 Lpcd has been selected for this study. It is noted that this value is based on all system uses, including the ICI sector. It is therefore inherently assumed the ICI water use will increase at the same proportion as residential growth in water demand.

The maximum day demand during the past five years is illustrated in the following bar chart.

Figure 4.1
Maximum Day Demand (2015-2019)



Therefore, the maximum day demand during the past five years was 2,685 m^3/day. Based on the 1,407m^3/day average annual water use during this period, the maximum day factor is calculated to be 1.9. For the current population of Mount Forest, MECP Guidelines recommend using a maximum day demand factor of 2.0, and this is what has been used in this study for the water supply, water storage and water distribution design calculations.

As part of the water use review, in order to confirm that there are no unusual trends in major metered water demands, metered water use records were obtained and reviewed for the past three years. The results of that review are summarized in the following tables and chart:

Table 4.3
Annual Metered Water Use (2017-2019)

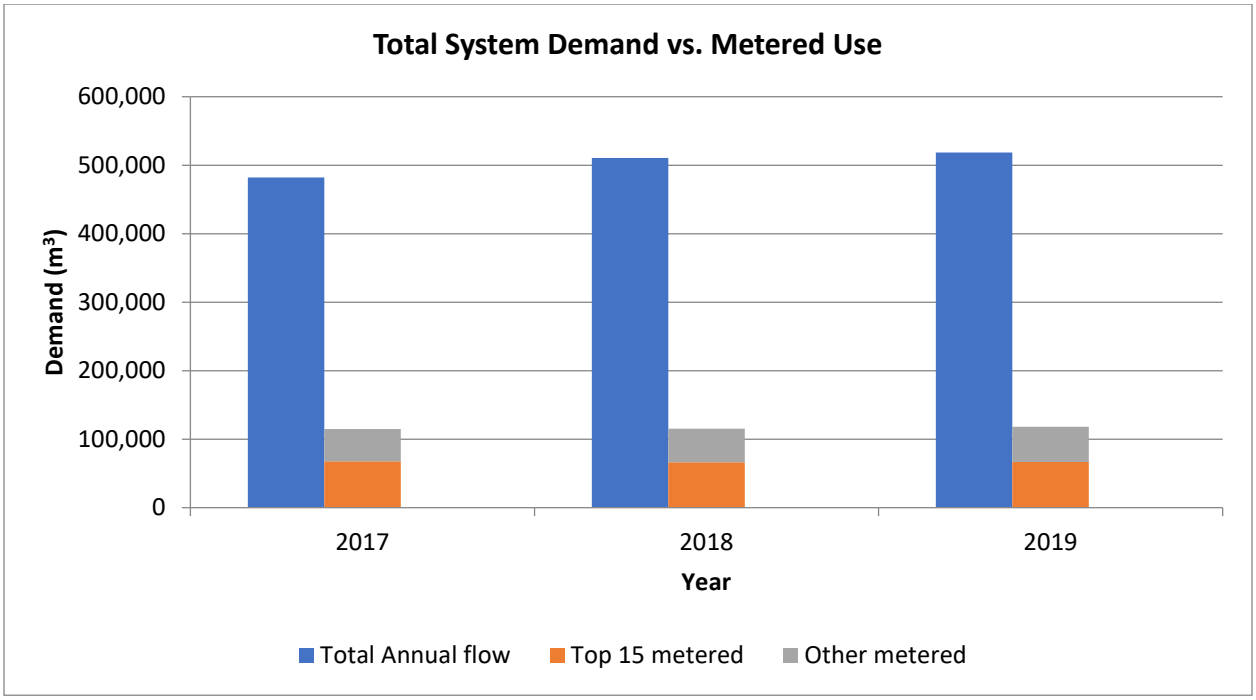
Metered Users	2017	2018	2019
Metered Use (m^3)	114,762	115,225	118,215
Total water use (m^3)	481,854	510,435	518,350
Percent of use that is metered	24%	23%	23%
Metered Use >250m^3/yr* (m^3)	102,813	102,039	106,014
Percent of metered use	90%	89%	90%
Top 15 metered users (m^3)	67,489	66,418	66,685
Percent of metered use	59%	58%	56%
*Equivalent to approximately one household average annual water usage			

Table 4.4
Highest Metered User Demands (2017-2019)

TOP 15 METERED USER WATER DEMAND (m^3/yr)

NAME		ADDRESS	2017	2018	2019	Average	Average % of Total System Water Use
SAUGEEN VALLEY NURSING	465	DUBLIN ST	12,350	11,363	11,162	11,625	2.31%
BIRMINGHAM RETIREMENT CMTY/ BLDG A+B	356	BIRMINGHAM ST E	7,943	8,396	8,844	8,394	1.67%
LONG MANUFACTURING LTD/DANA	205	INDUSTRIAL DR	7,094	7,001	7,390	7,162	1.42%
NORTH WELLINGTON HEALTH CARE	630	DUBLIN ST	6,071	7,421	5,349	6,280	1.25%
DDR AMERICAS INC	183	DURHAM ST W	5,546	5,751	7,083	6,127	1.22%
TWP OF WELLINGTON NORTH/ Arena	850	PRINCESS ST	8,313	4,319	3,251	5,294	1.05%
TIM HORTON'S DONUTS	319	MAIN ST S	2,938	3,562	3,414	3,305	0.66%
MOUNT FOREST IGA/ Foodland	121	MAIN ST S	3,077	3,108	2,944	3,043	0.60%
COUNTY OF WELLINGTON/white bluffs manor	450	ALBERT ST	3,572	1,975	2,535	2,694	0.54%
WELLINGTON CONDO CORP 137	401	BIRMINGHAM ST E	2,455	2,861	2,499	2,605	0.52%
TRICUBE INDUSTRIES INC	391	MAIN ST N	2,295	2,853	2,183	2,443	0.49%
TWP OF WELLINGTON NORTH/Pool	393	PARKSIDE DR	1,732	3,031	2,305	2,356	0.47%
SAAS SOLUTIONS INC	150	ELGIN ST S	1,745	2,334	1,906	1,995	0.40%
1507829 ONTARIO INC/ Knotty Pine fabrics	261	MAIN ST S	1,565	1,703	2,217	1,828	0.36%
COUNTY OF WELLINGTON	235	EGREMONT ST N	791	739	3,606	1,712	0.34%
		Total:	67,489	66,418	66,685	66,864	13.28%

Figure 4.2
Metered Water Use (2017-2019)



The metered water use has generally been consistent during the past three years and there are no noticeable trends. It is therefore considered appropriate to assume the ICI sector water demand will increase at the same pace as residential water demands. Therefore, for purposes of this study, projected overall system water use demands are based on the 275Lpcd value. **Should wet industries arise, this assumption and water system requirements should be revisited**.

In summary, based on a review of recent water demands and utilizing the Growth Plan population projections, the following water use design values have been established for purposes of this Technical Update study:

- 275 Lpcd (all uses – i.e. residential & ICI)
- Maximum day demand factor of 2.0, as per MECP Guidelines
- Peak rate (hour) demand factor of 3.0, as per MECP Guidelines

4.2 Water Supply

Mount Forest is currently serviced by four drilled bedrock well supplies. Their rated capacities are summarized in Table 4.5. Well pump information and pump curves are included as Appendix B, for reference. Graphs showing daily pumpage information, for the period of 2013-2019, are included as Appendix C, for general reference. It is noted that the graphs show a few days where the recorded maximum flow rate exceeded the Permitted capacity. It is assumed these generally would be anomalies or for operational reasons. This study did not include a detailed evaluation of well operations.

Table 4.5
Mount Forest Municipal Well Capacities

Well No.	Rated Capacity[1]	Operational Capacity[2]
3	22.7 L/s (1,920 m^3/d) @ 71.3 m. TDH	17.9 L/s[4]
4	22.7 L/s (1,920 m^3/d) @ 83.2 m TDH	19.1 L/s
5	45.5 L/s (3,849 m^3/d) @ 69.5 m TDH	32.2 L/s
6	45.5 L/s (3,849 m^3/d) @ 92.7 m TDH	32.7 L/s
Total	136.4 L/s (11,785 m^3/d)	101.9 L/s
Firm Capacity[3]	90.9 L/s (7,854 m^3/d)	69.2 L/s (5,976 m^3/d)

Notes:
1. As per the Permit to Take Water.
2. As per the discharge rate as presently operated (based on past 3-year average).
3. Equal to total well supply capacity with the largest supply out of service.
4. Reported actual capacity based on preliminary observations following December 2010 rehabilitation.

Well 3 capacity, based on observed well levels, has been throttled slightly to ensure that well supply is operated to maintain sufficient groundwater levels for proper well pump operations. Well 4 and Well 5 have been operated below the Permitted rate to help ensure no exceedances of the approved maximum pumping rates. Well 6 has high sulphide levels and has therefore historically been operated at a throttled rate.

Based on current operations, the operational firm well supply capacity is 69.2 L/s (5,976 m^3/d). The current maximum day demand is 2,685m^3/day, which is 44.9% of the current operational firm supply capacity. This indicates there is significant surplus firm supply capacity available for growth in the community of Mount Forest.

Well supply capacity is typically designed to accommodate the design maximum day demand with the largest well supply out of service for any reason. Using the Growth Plan populations, an average demand of 275Lpcd, and a maximum day factor of 2.0, the projected maximum day demand and, hence, the minimum required firm well supply capacity, has been calculated as summarized in the following Figure 4.3.

Therefore, it is predicted that the current mode of operating the four well supplies will provide sufficient firm supply capacity for Mount Forest for the next fifty years, beyond **Yr. 2070**. It is noted that the approved firm capacity of 7,854 m^3/day is significantly greater than the 50-year projected maximum day demand. This means the Township, if satisfied with the quality of water, could accommodate long-term water supply needs of the community beyond the 50-year planning horizon, by altering the mode of well supply operations (e.g. increasing the pumping rate of Wells 4, 5 & 6). Alternatively, a new well supply could be developed. Prior to increasing the operational capacity of any well supply, given the historically lower operating mode and, therefore, lack of long-term water level and actual well supply capacity information at higher sustained pumping rates, it is recommended that a hydrogeologist be retained to confirm the increased supply capacities.

The water supply calculations have assumed that all of the existing urban population and growth, as presented in the Growth Plan, are and will be serviced by the water system. This is a conservative assumption because, as previously noted, there are currently some unserviced areas within the urban boundary.

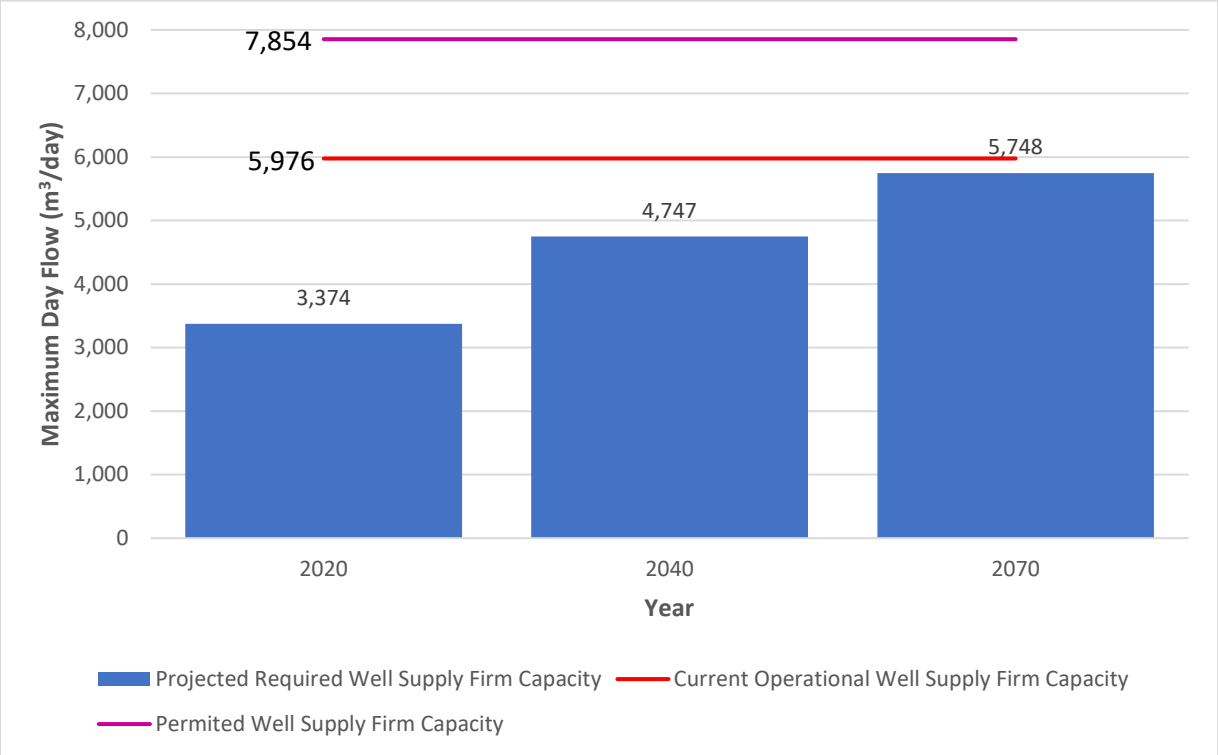
Based on a Raw Water Assessment evaluation report that was prepared in early-2020, the existing water quality supplied by the production wells is acceptable, although the sodium concentrations at Wells 3 & 5 are greater than the reportable limit. That report concluded there are no observed water quality trends at this time. Sulphides have been noted in the past, by the Operator, as an aesthetic concern for at least Well No. 6.

As an aside, the Township Operator indicates that, normally, only one or two duty well pumps operate in any given day to keep the standpipe at its normal operating levels.

The Operator has noted that during some larger watermain breaks, nearby well supply will alarm out as low chlorine residual and the well pump will lock out (anticipated to be due to low pump runout pressures). In order to help avoid a low chlorine residual alarm condition, which leads to additional operational efforts to reinstate the well supply, the Operator plans to upgrade the well pumphouses to use flow-paced chlorine metering pumps.

A well supply reserve capacity calculation table is included as Appendix K.

Figure 4.3
Required Well Supply Firm Capacity



4.3 Water Storage

a) Design Water Storage Volume

Required water storage volume, as per MECP Guidelines, is characterized by fire, equalization, and emergency storage components, as follows:

Storage volume = A + B + C

Where, A = fire storage (based on serviced population; see MECP tables);
B = equalization storage (to accommodate diurnal peak daily demands; 25% of maximum day demand);
C = emergency storage (25% of A + B).

The sizing of the equalization storage component is based on having well supply capacity equal to or greater than the water system's maximum day demand. This is the circumstance for Mount Forest, which has available surplus firm supply capacity beyond Yr. 2070. It is noted that MECP Guidelines indicate surplus water supply capacity could be credited to a reduction in storage volume; however, given some concerns with supply aesthetic water quality, it is not recommended to reduce the calculated size of water storage due to current surplus supply capacity. It is further noted that elevated water storage facilities typically have a design lifespan of 80-100 years or greater, and hence it is desirable to ensure any new elevated storage is sized sufficiently for growth that exceeds the current study planning period.

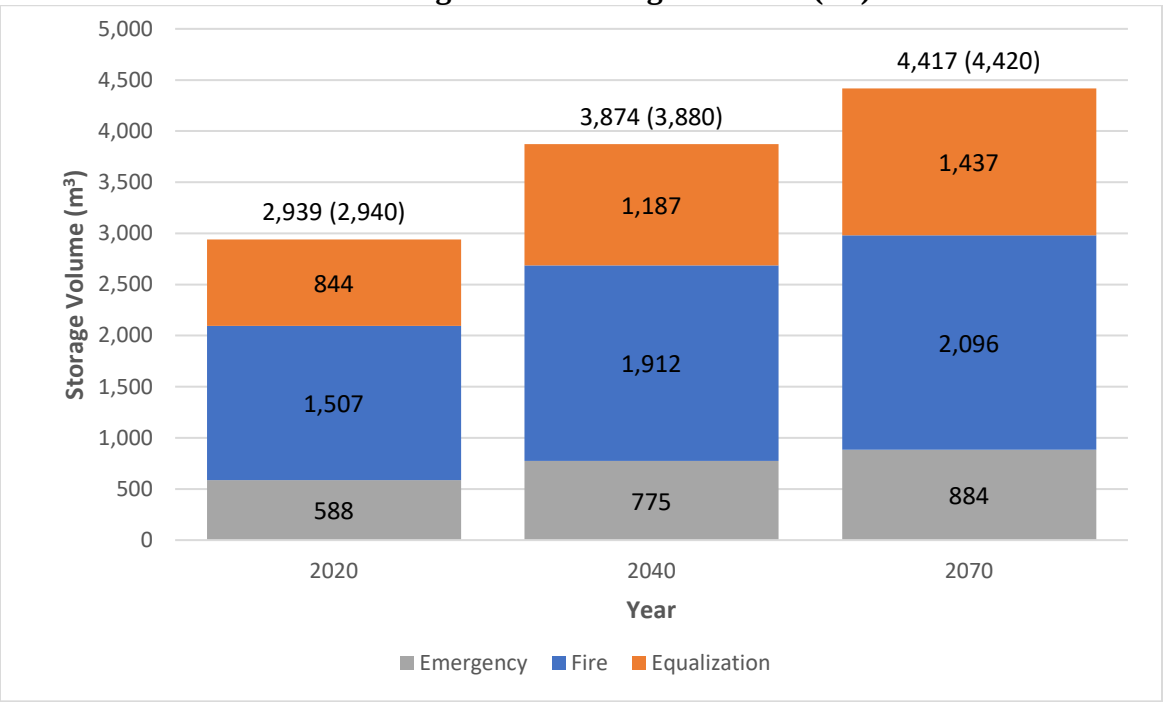
The following table and chart present the calculated water storage capacities required for the planning period. These calculations have assumed that all of the urban population and growth, as presented in the Growth Plan, are and will be serviced by the water system. It is also assumed that a 50-year projection is reasonable for use in sizing the total storage volume required. At the time of detailed design, the Township could consider providing for a larger storage volume.

Table 4.6
Calculated Design Water Storage Volumes (m^3)

Year	Population	Fire	Equalization	Emergency	Total (rounded)
2020	5,678	1,507	844	588	**2,940**
2040	8,378	1,912	1,187	775	**3,880**
2070	10,449	2,096	1,437	884	**4,420**

Therefore, the minimum 50-year design water storage capacity is 4,420 m^3. The current effective storage capacity of the 35-year-old standpipe (Yr. 1985) is 2,000m^3, based on the use of a booster pumping station during higher demand periods such as a fire event. Therefore, if constructing a second storage facility, a minimum additional 2,420m^3 is required. Alternatively, if the existing standpipe is demolished and replaced, a single new storage facility could be constructed with a minimum capacity of 4,420m^3.

Figure 4.4
Design Water Storage Volumes (m^3)



As an aside, the Township Operator has indicated that, other than monthly manually operating the booster pump for testing, the booster pumping station has only been activated during several large watermain breaks. Up to only two of the four well supplies are typically active at any given time to keep the standpipe filled to normal operating levels.

b) Evaluation of Water Storage Expansion Alternatives

The scope of this Technical Update study included an evaluation of elevated water storage alternatives to address a lack of recommended total storage capacity for Mount Forest. This study did not include evaluating other alternatives, such as ground-level storage. Specifically, the following elevated storage alternatives were selected by the Township for evaluation:

- Alternative No. 1: A new single elevated tank at the existing standpipe and community pool site.
- Alternative No. 2: As with past studies, a new second elevated storage facility located at the north end of town, in the form of an elevated tank.
- Alternative No. 3: A new single elevated tank located at the north end of town

A high-level comparison of various types of elevated tanks was completed (e.g. glass bolted; stainless steel; dual zone). A summary is included as Appendix D. Based on this comparison, the Township decided to only consider conventional steel coated welded composite elevated tanks (CET).

Alternative No. 1: Single New Elevated Storage at Existing Parkside Drive Site

This alternative is to demolish the existing Grant Street standpipe (and the community pool, which is slated for future decommissioning) and construct a single large, elevated tank at this expanded site. Some general considerations given to this alternative are as follows:

- Only one facility to maintain.
- A booster pumping station (BPS) was constructed in 2007 to allow for the full utilization of the standpipe contents. If the existing 35-year-old standpipe and relatively new BPS are demolished, that investment would be lost.
- Small site within a built urban area surrounded by residential, commercial, and institutional (school) land uses. This results in there being a number of construction complexities for a new larger elevated tank, due to there being a lack of clear access on all sides, adjacent land uses, and existing features on the site:
    - Keep standpipe in service
    - Containment at various phases
    - Steel erection inefficiency
    - Additional crane size and mobilizations
    - Bigger lifts/ longer durations
    - Pump house protection/ repair
    - Additional site security
    - Shoring
    - Other mobilization inefficiencies
- Premium on the capital cost, due to small size of this site and its accompanying constraints within this existing built area of town.
- Premium on maintenance costs, due to these site constraints.
- Maximizes the utilization of existing water distribution infrastructure (trunk mains) that were historically constructed to connect this storage site to the various parts of this community.
- Can utilize existing building infrastructure for servicing the new storage facility or for housing new equipment (electrical power supply; SCADA).
- Storage height not limited by the height of the existing standpipe.
- Opportunity to increase system pressures by constructing a higher elevated storage facility, possibly to also service the higher area in the southeasterly corner of the community which would otherwise need a booster pumping station and separate pressure zone. Currently, normal system pressures at/near the Standpipe are below preferred minimum normal pressures of 350kPa (but >305kPa).
- As noted in the following water distribution section of this report, a minimum bottom of equalization elevation for a new elevated tank of 468m would be required to allow servicing of higher areas in the southeasterly corner of the community without the need for a separate pressure zone and booster pumping station.
-

Alternative No. 2: Second Supplemental Elevated Storage in the Industrial Park

This alternative is to maintain the existing storage infrastructure (Standpipe + associated Booster Pumping Station) and supplement the long-term storage needs by constructing a second elevated storage facility at the opposite northerly end of the community, within the expanded north

industrial development area, west of Highway No. 6. This was the preferred alternative selected in previous servicing master plans. Some general considerations given to this alternative are as follows:

- Provides redundancy of storage (i.e. one facility can be temporarily removed from storage during maintenance of the other facility, although short-term reduced fire flow capability can be expected to certain parts of the system during the outage of one of these water storage facilities and that would need to be taken into consideration at the time of the outage)
- Two facilities to operate and maintain (i.e. higher anticipated O&M costs).
- Due to the current condition of the Standpipe, a full interior/exterior recoating is recommended within the next few years (refer to a May 14, 2019, Landmark inspection report).
- Will slightly reduce vacant land availability for industrial sale and use.
- Green field development site, allowing for optimum sizing of lot.
- Lower ground surface elevation (by 14±m), in comparison to the existing Standpipe site, requires a taller structure than Alternative #1.
- Also, given the height of the storage that will be required at this site and limitations to the height of standpipes, the recommended type of storage at the north end of the community is an elevated tank.
- Storage height of the new elevated tank will be limited by the height of the existing standpipe.
- More complex operations to consider at time of detailed design (i.e. tendency would be that water will circulate more in/out of the new elevated tank in comparison to the standpipe, due to the configuration of the two different styles of elevated storage; water quality and icing issues would need to be considered to ensure no problems with both storage facilities but in particular the standpipe).
- Requires resolution of Planning and other matters related to this proposed site which is located beyond the current urban boundary and within a different municipality.

<u>Alternative No. 3: Single New Elevated Storage in the Industrial Park</u>

- Only one facility to maintain.
- A booster pumping station (BPS) was constructed in 2007 to allow for the full utilization of the standpipe contents. If the existing 35-year-old standpipe and relatively new BPS are demolished, that investment would be lost.
- Loss of benefit existing Standpipe site has in terms of existing water distribution infrastructure network (trunk mains) that was historically configured and sized to connect that storage to the various parts of this community.
- Storage height not limited by the height of the existing standpipe.
- Opportunity to increase system pressures by constructing a higher elevated storage facility, possibly to also service the higher area in the southeasterly corner of the community which would otherwise need a booster pumping station and separate pressure zone. Currently, normal system pressures at/near the Standpipe are below preferred minimum normal pressures of 350kPa.

- As noted in the following water distribution section of this report, a minimum bottom of equalization elevation for a new elevated tank of 468m would be required to allow servicing of higher areas in the southeasterly corner of the community without the need for a separate pressure zone and booster pumping station. Loss of community landmark at south entrance into town.
- Will slightly reduce vacant land availability for industrial sale and use.
- Green field development site, allowing for optimum sizing of lot.
- Lower ground surface elevation (by 16±m) requires a taller structure than the existing site (extra capital cost).
- Also, given the height of the storage that will be required at this site and limitations to the height of standpipes, the recommended type of storage at the north end of the community is an elevated tank.
- Requires resolution of Planning and other matters related to this proposed site which is located beyond the current urban boundary and within a different municipality.

WaterCAD™ Modeling

A WaterCAD™ model was used to evaluate the water storage alternatives. For more information on the modeling work completed, refer to the following "Water Distribution System" section and related appendices. Generally, the modeling work concludes the following with respect to the water distribution system performance for the storage alternatives that were evaluated:

- Alternative No. 1 (single CET at existing site) would technically provide an enhanced performance for the distribution system in comparison to the existing Standpipe, due to the higher storage elevation. Given lower topography at the northerly part of the community, the conveyance of fire flows to the community for a single elevated storage alternative performs better with this Alternative No. 1 in comparison to Alternative No. 3.
- Alternative No. 2 technically will perform better than Alternative No. 1 even though the storage elevation will remain the same (lower than Alternative No. 1 & No. 3), given this alternative includes maintaining the existing Standpipe (i.e. two storage facilities to "split" the flow to the community and proximity at either extremity of the system to supply demands at the south, central and north ends of town). This alternative will also provide enhanced performance within the northerly and central portions of the community in comparison to the existing single Standpipe situation, and this is a result of the location of a second storage facility at the opposite end of town.
- Alternative No. 3 technically will result in a declined performance of the distribution system in the central and southerly areas of the community, even with practical increases to this storage facility's height. The available fire flows will significantly decrease to these areas of the community and will marginally drop below target levels within the downtown business core. This reduced performance is primarily related to topography; the new single storage facility under this alternative would be located much farther away from the higher ground elevations of the community resulting in less available headloss to supply fire flows. Further, the community's internal water distribution trunk network was constructed based on the current storage location.

It would appear from the modeling work that the preferred choice would be Alternative No. 1 or Alternative No. 2, and that Alternative No. 3 should receive no further consideration.
It is noted that a higher elevated storage facility (Alternatives 1 & 3) can be expected to result in an increased water demand (higher pressure = higher fixture and leakage flow rates). It may also result in a higher watermain breakage rate (e.g. old cast iron pipes subject to a higher pressure). There will be an increase in well pump energy use.

Comparison of Alternatives

Opinions of probable costs were formulated as part of the storage alternative comparison. In addition, probable costs were established for external watermain that would be required to connect the Alternative No. 2 and Alternative No. 3 facilities to the existing water distribution system. Further, a high-level life cycle cost comparison was completed. These probable cost estimates are included as Appendix E, and summarized in the following Table 4.7

As mentioned previously, Alternative No. 3 is not considered an acceptable alternative due to reduced water distribution performance for the conveyance of fire flows. Based on a 64-year life cycle analysis, it would appear that Alternative No. 1 and Alternative No. 2 may have a similar lifetime cost. Given the significantly lower capital cost for Alternative No. 2, it would appear to be the best candidate for selection by the Township as the preferred alternative. However, that would then require a separate pressure zone and pumping station to service the future development area that is south of Oxford Street and to the east of Main Street. Alternative No. 1 may therefore be a desirable option. .

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

Class Environmental Assessment and future design work

The final selection of the elevated storage preferred alternative will be part of a future Schedule B Class EA. The Township should budget for completing that study work, as well as the capital cost of new storage and associated works ($5.0M to $5.6M).

The following should be considered at the time of detailed design (not a comprehensive list):

- How to maintain water quality in the water storage facility(s), in particular during the initial decades of operation for a facility(s) designed to service a future higher population.
- Similarly, how to prevent icing problems during the winter.
- For Alternative No. 2, the above becomes more complex with two different types of elevated storage in service.
- SCADA
- For Alternative No. 2, with a second different type of storage facility, some consideration would need to be given to operations to ensure sufficient turnover of the contents of each facility, for quality and winter icing reasons.
- Need or desire to upgrade the well pumps, motors, and any related electrical (Alternatives 1 & 3). Appendix B includes available well pump curves. A very preliminary review of those pump curves, assuming a 5m (16ft) increase in the new elevated storage water level, indicates there may be approximately an 8% decrease in the available pumping capacity but that the pumps could still operate at or above their current operational capacity. Given the surplus well capacity exceeds the 50-year design demand projection, and the expectation that the pumps can still operate satisfactorily at the higher head, the Township could probably defer upgrading well pumps until the next opportune pump maintenance interval. This should be reviewed at the time of detailed elevated storage design.
- Size of property for the elevated tank would ideally be in the order of 1.0ha, with a minimum width in the order of 50m. The actual preferred dimensions of the site depends on the final size of the elevated tank and should take into consideration construction access and maintenance (e.g. recoating) access.

At this time, the Township is considering expanding its water storage capacity within the next five years. Currently, there is excess well supply capacity available. Well 3 has standby power. Consideration can be given to ensuring readily available portable standby power for Well 5 or Well 6 to help mitigate the risk associated with available storage being less than that recommended by MECP.

4.4 Water Distribution System

As part of past study work, a WaterCAD™ model was established and calibrated. It was updated as part of this study, incorporating the updated GIS database information, including watermains constructed since the previous study work was completed. Details are presented in Appendix F.

As previously noted, normal system pressures for the existing distribution system ranges from 305kPa to 535kPa. MECP recommends normal system pressures be 350kPa to 480kPa, but no lower than 275kPa and no higher than 700kPa. System-wide pressures should remain at or above 140kPa during maximum day demand + fire flow conditions. System pressures are currently governed by the standpipe operating levels. The area adjacent to the standpipe, and to the east/northeast of the standpipe, have normal system pressures below 350kPa. If replacing the standpipe, consideration could be given to establishing a new elevated tank to a higher elevation.

The future development area south of the existing and unopened Oxford Street road allowance is at higher elevations and cannot be serviced at this time without the creation of a separate, higher pressure zone serviced by a booster pumping station. Another alternative that could be considered is the construction of a new higher elevated storage facility to replace the existing standpipe. Such a facility would need to have a minimum bottom of equalization storage elevation greater than an elevation of approximately 468m to achieve a normal pressure of 275kPa in that area. This would result in overall normal system pressures of 275 to 580kPa.

For Mount Forest, the governing criteria for sizing of watermain is generally the maximum day + fire flow scenario. The Township in the past selected the following minimum target fire flow capabilities within the distribution network:

- 50 L/s, low density residential (e.g. single-family dwellings)
- 75 L/s, medium density residential (e.g. row townhouses)
- 150 L/s, for ICI
- 225 L/s, for the downtown commercial business core

It is noted that recommended minimum fire flows are based on the type and density of land use and building construction, and varies both in terms of volume and duration. It is recommended that the fire protection level be reviewed by the Fire Department at the time of any new developments to confirm appropriate fire protection levels are being achieved.

It is noted that, for the fire flow evaluation, the available fire flow capacity is based on the capability of the distribution system to transmit those flows to the evaluated locations. Actual capabilities of utilizing that available capacity depends on the number and spacing of fire hydrants and the fire fighting equipment that is being utilized. This study did not include such an evaluation. This should be considered by the Fire Department when reviewing existing or new development for fire prevention servicing.

Modeling was used to size watermain extensions to future development areas and to determine the need for additional watermain looping to achieve the selected level of service. The results

are summarized in Appendix F and in the following Recommended Drinking Water System Projects section.

Modeling identified locations throughout the existing distribution system where minimum 50L/s residential target fire protection levels are not achieved. This is a result of, or combination of, small diameter watermain (<150mm dia.), old watermain assumed to have deteriorated transmission capacity (i.e. cast iron), or longer dead-end watermain segments. The Township should continue with its long-term strategy of upgrading these watermains as part of road reconstruction projects or as development interests require.

According to the Township's GIS database, there is approximately 4.3 km of old cast iron watermain that is still being used to service parts of the community of Mount Forest, as presented in Figure 4.5. The Township typically has been progressively replacing these types of watermain as part of its road reconstruction projects. These cast iron watermains typically experience higher breakage rates, are more susceptible to frost action (typically are shallower installations), and they can contribute to distribution system aesthetic water quality issues including reduced chorine residuals. Figure 4.5 also shows the location of watermain breaks since 2004. The calculated cast iron watermain breakage rate, for sections that currently remain in service, is 0.14 breaks/km/year. See also Appendix "G" for additional details. Figure 4.5 also shows non-cast iron, small diameter watermain. Since the Township's distribution system is intended to provide fire protection for the community, MECP Guidelines recommend minimum 150mm dia. watermain, to provide minimum fire flows to residential areas. Larger watermain should be considered if servicing higher density or ICI uses, such as on Dublin Street (hospital; medical clinic, seniors/nursing home). A 250mm dia. trunk watermain had been constructed on Egremont Street, from Queen Street to Durham Street, and it is recommended to complete that trunk watermain loop to Sligo Road when replacing older mains in that area (i.e. route will likely depend on road reconstruction priorities, but could consider replacing the Durham-Fergus Street cast iron main with new 250mm dia. mains).

The structural condition of the existing distribution system was not evaluated as part of this study. However, two significant relatively recent watermain breaks have been identified by the Township on 250mm dia. ductile iron watermain on or near Queen Street West:

- One was a longitudinal crack down the length of the pipe
- Once was an end cap blow off; appears the bolts holding the cap had corroded away

At this time, the Township is not aware that there is a system-wide issue with ductile iron watermain corrosion, but this should be monitored in the future and if the frequency of such incidents increases then consideration should be given to implementing measures to protect that infrastructure (e.g. add corrosion protection, if appropriate).

Cast Iron watermain

STREET NAME	FROM	TO	SIZE (mm)	LENGTH (m)
BIRMINGHAM ST	Queen ST W	Weber ST	150	220
BIRMINGHAM ST	Weber ST	Normanby ST W	150	227
BIRMINGHAM ST	Normanby ST W	Elgin ST N	200	170
BIRMINGHAM ST	Elgin ST N	Main ST N	200	154
BIRMINGHAM ST	Main ST N	Fergus ST N	150	6
BYELAND DR	Sligo road E	Egremont ST N	150	487
DUBLIN ST	Martin St	Princess St	150	12
DURHAM ST	Main ST N	Fergus ST N	100	160
DURHAM ST	Fergus ST N	Egremont ST N	100	140
DURHAM ST	Egremont ST N	Church ST N	150	81
EGREMONT ST	BYELAND DR	Durham ST E	150	128
FERGUS ST	Sligo road E	Durham ST E	100	294
FERGUS ST	Durham ST E	Birmingham ST E	100	183
FERGUS ST	Birmingham ST E	Wellington ST E	100	125
GRANT ST	Main ST S	Parkside DR	300	64
JOHN ST	Queen ST W	Waterloo ST	100	215
KING ST	Main ST S	Fergus ST S	100	161
KING ST	Fergus ST S	Egremont ST S	100	145
MURPHY ST	Main ST S	115m East from Main ST S	100	115
NORTH WATER ST	Peel ST	Main ST S	50	110
PEEL ST	Queen ST E	York ST	100	177
PEEL ST	York ST	North water ST	100	89
South Water ST	Main St S	Bristol ST (unopened)	100	339
South Water ST	Bristol ST (unopened)	SW end of Southwater ST	150	263
WELLINGTON ST	Fergus ST S	Egremont ST S	150	141
YORK ST	Peel ST	Queen ST E	100	128
				4,335

Non-Cast Iron Watermain ≤ 100mm dia

STREET NAME	FROM	TO	SIZE(mm)	LENGTH(m)
DUBLIN ST	Princess Anne St	Waterloo St	100	150
DUBLIN ST	Waterloo St	Queen St	100	188
PRINCE CHARLES ST	Dublin St	Arthur St	100	136
QUEEN ST	Parkside Dr	Main St	100	129
SLIGO RD	Church St	Byeland Dr	38	48
YORK ST	Queen St	Peel St	100	83
YORK ST	Queen St	Peel St	25	80
				815

	Number of breaks			No. of breaks/km/yr for mains still in service
Pipe Material	2004-2020	Last ten years 2011-2020	For mains still in service	
Cast Iron	16	12	9	0.14
Ductile Iron	7	5	6	N/A
Iron Pipe	8	1	4	N/A
Unknown	4	3	2	N/A
P.V.C	3	1	3	N/A
Length of C.I. watermain still in service (m), as of Yr. 2020				4,335
No. of years applicable to those mains				15.4
Note: Above break statistics based on Operator log sheets				

NOTES:
This is a schematic representation of the water distribution system (and roadways). While this drawing and its detail views are shown to a scale, symbols, roadway widths, and watermains are not plotted to scale. Exact locations of many works are not known (based on old non-GPS data). This mapping should be used for general information purposes only.

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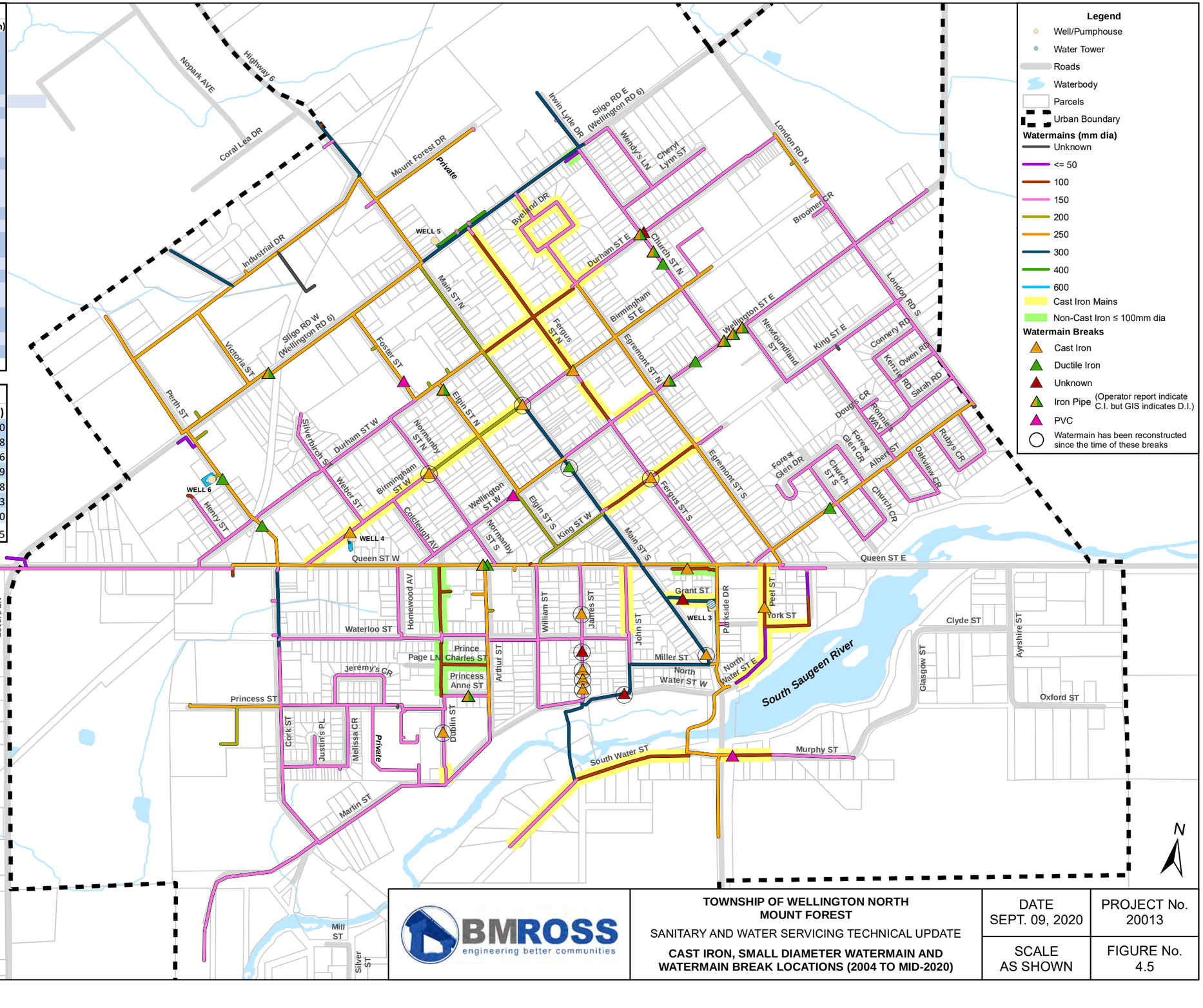
METRES



BMROSS engineering better communities

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

CAST IRON, SMALL DIAMETER WATERMAIN AND WATERMAIN BREAK LOCATIONS (2004 TO MID-2020)

DATE	PROJECT No.
SEPT. 09, 2020	20013
SCALE	FIGURE No.
AS SHOWN	4.5

4.5 Recommended Drinking Water System Projects

Based on the scoped study evaluations completed, the following Drinking Water System (DWS) projects are anticipated during the next 20-year planning period:

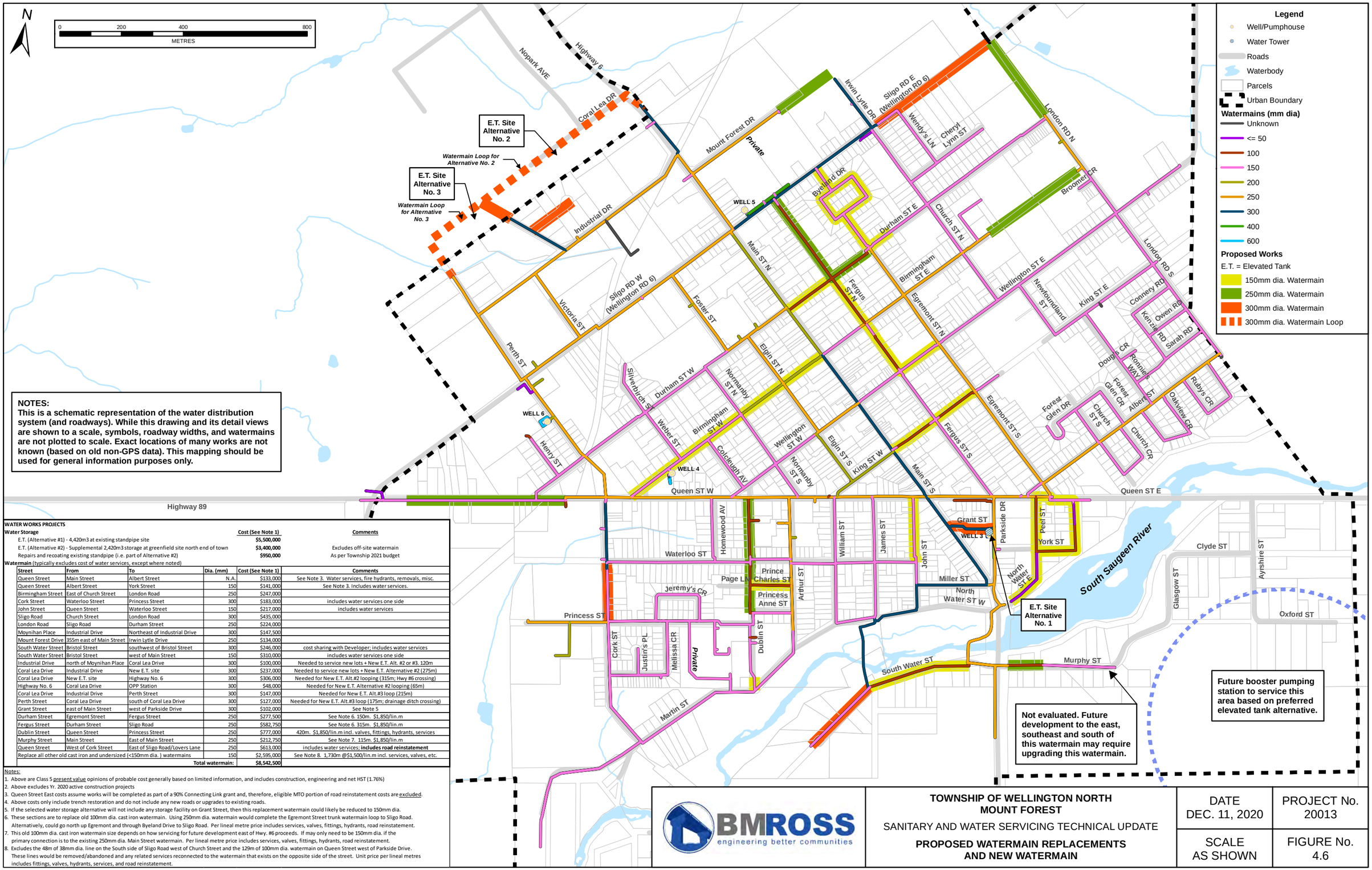
1. Construct a new second elevated storage tank at the north end of the community with a minimum capacity of 2,420 m3 (Alternative No. 2) and repair/recoat the interior/exterior of the existing Standpipe, or demolish the existing Standpipe (and disconnect the existing booster pump) and replace it with a new higher elevated storage tank at the same but expanded site with a minimum capacity of 4,420 m3 (Alternative No. 1). Complete a Schedule B Class EA to finalize an evaluation of these two alternatives prior to selecting the preferred alternative.
2. Replace the 300mm dia. Grant Street cast iron watermain (i.e. prioritize this if elevated storage Alternative No. 1 is selected as the preferred alternative).
3. Replace the John Street 150mm dia. cast iron watermain, from Waterloo Street to Queen Street, as part of a road reconstruction project.
4. Construct 300mm dia. watermain on future Moynihan Place, located within the existing Industrial Drive area, to service new industrial lots.
5. Extend the 300mm dia. Industrial Drive watermain, from Moynihan Place to Coral Lea Drive, and along Coral Lea Drive to the new elevated water storage tank (if this is the selected storage alternative and the selected site), and to service new industrial lots.
6. Extend the 250mm dia. Birmingham Street watermain, from east of Church Street to London Road, depending on development schedule.
7. Select watermain and water service replacements on Queen Street, from Main Street to York Street, as part of a future MTO Highway Connecting Link funded project (road items would be eligible for MTO funding, but not the watermain).
8. Replace the existing watermain on Cork Street, from Waterloo to Princess Street, using 300mm dia. watermain, to improve fire flows to the nearby institutional land uses and future residential development.
9. As part of Phase 1 of the Avila subdivision, replace the existing South Water Street watermain, from the proposed SPS to the southwesterly end of the street, and extend it through the unopened road allowance and into the subdivision lands. This work is to be completed by the Developer. There may be some cost sharing with the Township.
10. Continue replacing old cast iron and small diameter (<150mm) watermains, typically as part of progressively completing street reconstruction within the community, or in accordance with priorities due to increased breakage rates or other problems with specific sections of this old watermain. As a minimum, match the existing watermain size except no smaller than 150mm dia. Consider replacing the northerly Egremont Street and one leg of the Byeland Drive watermain using 250mm dia., to finish the Egremont Street trunk watermain looping to Sligo Road (or else via. a Durham-Fergus Street route). Consider replacing the Dublin Street watermain using 250mm dia., to improve fire flows to the institutional locations at/near Princess Street (hospital, seniors/nursing home, medical clinic).
11. Replace existing 150mm dia. watermain road crossing at the Queen/Cork Street intersection with 300mm dia. watermain, the next time road work is completed on Queen Street. At the time of any watermain replacement work, consider works located within

the intersection that may not have been replaced at the time side streets were reconstructed).

12. Complete an overview of hydrant locations with the Fire Department and determine where additional fire hydrants are needed to achieve target operational fire flows based on land uses within the community.
13. Consider increasing the frequency of sampling and testing Well No. 5 for sodium and chloride to look for trends.
14. Consider increasing the frequency of sampling and testing Well No. 6 for sulphate and hydrogen sulphide to look for trends.
15. Upgrade the well pumphouses with flow-paced chlorine metering pumps, to avoid low chlorine alarm conditions that occur during large watermain break situations, and that requires flushing and sampling to reinstate the affected well supply.

Recommended works are presented on Figure 4.6, along with costs (see also Appendix E).

Other DWS works identified in this report should be completed as development interests dictate. At this time, they are not included in the recommendations since there are no known current active development interests that require those works.



NOTES:
This is a schematic representation of the water distribution system (and roadways). While this drawing and its detail views are shown to a scale, symbols, roadway widths, and watermains are not plotted to scale. Exact locations of many works are not known (based on old non-GPS data). This mapping should be used for general information purposes only.

WATER WORKS PROJECTS

Water Storage	**Cost (See Note 1)**	**Comments**
E.T. (Alternative #1) - 4,420m3 at existing standpipe site	**$5,500,000**	
E.T. (Alternative #2) - Supplemental 2,420m3 storage at greenfield site north end of town	**$3,400,000**	Excludes off-site watermain
Repairs and recoating existing standpipe (i.e. part of Alternative #2)	**$950,000**	As per Township 2021 budget

Watermain (typically excludes cost of water services, except where noted)

Street	From	To	Dia. (mm)	Cost (See Note 1)	Comments
Queen Street	Main Street	Albert Street	N.A.	$133,000	See Note 3. Water services, fire hydrants, removals, misc.
Queen Street	Albert Street	York Street	150	$141,000	See Note 3. Includes water services.
Birmingham Street	East of Church Street	London Road	250	$247,000	
Cork Street	Waterloo Street	Princess Street	300	$183,000	includes water services one side
John Street	Queen Street	Waterloo Street	150	$217,000	includes water services
Sligo Road	Church Street	London Road	300	$435,000	
London Road	Sligo Road	Durham Street	250	$224,000	
Moynihan Place	Industrial Drive	Northeast of Industrial Drive	300	$147,500	
Mount Forest Drive	355m east of Main Street	Irwin Lytle Drive	250	$134,000	
South Water Street	Bristol Street	southwest of Bristol Street	300	$246,000	cost sharing with Developer; includes water services
South Water Street	Bristol Street	west of Main Street	150	$310,000	includes water services one side
Industrial Drive	north of Moynihan Place	Coral Lea Drive	300	$100,000	Needed to service new lots + New E.T. Alt. #2 or #3. 120m
Coral Lea Drive	Industrial Drive	New E.T. site	300	$237,000	Needed to service new lots + New E.T. Alternative #2 (275m)
Coral Lea Drive	New E.T. site	Highway No. 6	300	$306,000	Needed for New E.T. Alt.#2 looping (315m; Hwy #6 crossing)
Highway No. 6	Coral Lea Drive	OPP Station	300	$48,000	Needed for New E.T. Alternative #2 looping (65m)
Coral Lea Drive	Industrial Drive	Perth Street	300	$147,000	Needed for New E.T. Alt.#3 loop (215m)
Perth Street	Coral Lea Drive	south of Coral Lea Drive	300	$127,000	Needed for New E.T. Alt.#3 loop (175m; drainage ditch crossing)
Grant Street	east of Main Street	west of Parkside Drive	300	$102,000	See Note 5
Durham Street	Egremont Street	Fergus Street	250	$277,500	See Note 6. 150m. $1,850/lin.m
Fergus Street	Durham Street	Sligo Road	250	$582,750	See Note 6. 315m. $1,850/lin.m
Dublin Street	Queen Street	Princess Street	250	$777,000	420m. $1,850/lin.m incl. valves, fittings, hydrants, services
Murphy Street	Main Street	East of Main Street	250	$212,750	See Note 7. 115m. $1,850/lin.m
Queen Street	West of Cork Street	East of Sligo Road/Lovers Lane	250	$613,000	includes water services; **includes road reinstatement**
Replace all other old cast iron and undersized (<150mm dia.) watermains			150	$2,595,000	See Note 8. 1,730m @$1,500/lin.m incl. services, valves, etc.
		Total watermain:		**$8,542,500**	

Notes:
1. Above are Class 5 present value opinions of probable cost generally based on limited information, and includes construction, engineering and net HST (1.76%)
2. Above excludes Yr. 2020 active construction projects
3. Queen Street East costs assume works will be completed as part of a 90% Connecting Link grant and, therefore, eligible MTO portion of road reinstatement costs are excluded.
4. Above costs only include trench restoration and do not include any new roads or upgrades to existing roads.
5. If the selected water storage alternative will not include any storage facility on Grant Street, then this replacement watermain could likely be reduced to 150mm dia.
6. These sections are to replace old 100mm dia. cast iron watermain. Using 250mm dia. watermain would complete the Egremont Street trunk watermain loop to Sligo Road. Alternatively, could go north up Egremont and through Byeland Drive to Sligo Road. Per lineal metre price includes services, valves, fittings, hydrants, road reinstatement.
7. This old 100mm dia. cast iron watermain size depends on how servicing for future development east of Hwy. #6 proceeds. If may only need to be 150mm dia. if the primary connection is to the existing 250mm dia. Main Street watermain. Per lineal metre price includes services, valves, fittings, hydrants, road reinstatement.
8. Excludes the 48m of 38mm dia. line on the South side of Sligo Road west of Church Street and the 129m of 100mm dia. watermain on Queen Street west of Parkside Drive. These lines would be removed/abandoned and any related services reconnected to the watermain that exists on the opposite side of the street. Unit price per lineal metres includes fittings, valves, hydrants, services, and road reinstatement.

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TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

PROPOSED WATERMAIN REPLACEMENTS AND NEW WATERMAIN

DATE	PROJECT No.
DEC. 11, 2020	20013
SCALE	FIGURE No.
AS SHOWN	4.6

5.0 SANITARY

5.1 Sanitary Sewage Flows

The sanitary sewage serviced population is less than the community population, since not all areas within the urban boundary are serviced (e.g. built areas south of the South Saugeen River are serviced by private individual Class IV sewage disposal systems). A comparison of the assumed populations based on the Township's annual reserve capacity calculations and the Growth Plan are summarized as follows:

Table 5.1
Serviced vs. Total Population Estimates

Year	Reserve Capacity Calculations*		Growth Plan	
	Serviced Population	Growth rate	Total Population	Growth rate
2017	4785		5308	2.27%
2018	4832	0.98%	5429	2.27%
2019	4914	1.70%	5552	2.27%

**Source: Triton Engineering annual calculations*

There appears to be a higher gap between these populations than expected, which may be due to the reserve calculations being based on a lower household density of 2.15 persons whereas the Growth Plan assumes 2.4 to 2.5 persons per household. To be conservative, sewage per capita flows were calculated based on the lower populations as used in the reserve capacity calculations.

Sanitary sewage flows for the past three years were reviewed for the following three SPSs:

- Cork Street SPS
- Durham Street SPS
- North Water Street SPS (NWS-SPS)

The daily flows from these stations are presented in Figure 5.1 and 5.2. The annual flow is summarized in Table 5.2

The 2019 Cork Street data, and hence the calculated gravity sewage flow, is suspect due to apparent faulty readings during the July-August period. This may have been the result of a faulty check valve (i.e. 2019 OCWA annual report mentions repair of a check valve at this station).

It is noted that all sanitary sewage flow from the serviced areas of the community ends up at the NWS-SPS, where it is pumped to the WWTP. The total sewage flow (i.e. NWS-SPS) is summarized in the following table and chart.

Figure 5.1
Annual Sewage Volume (m^3)

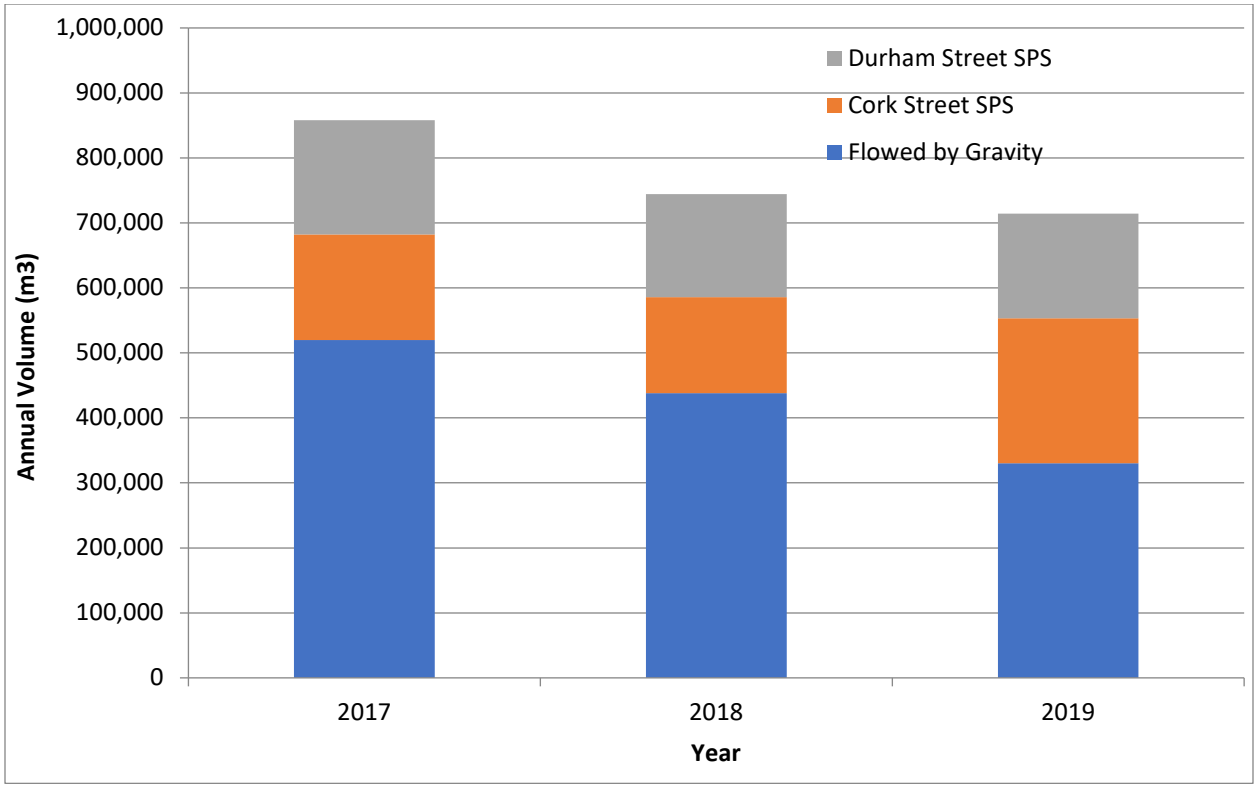
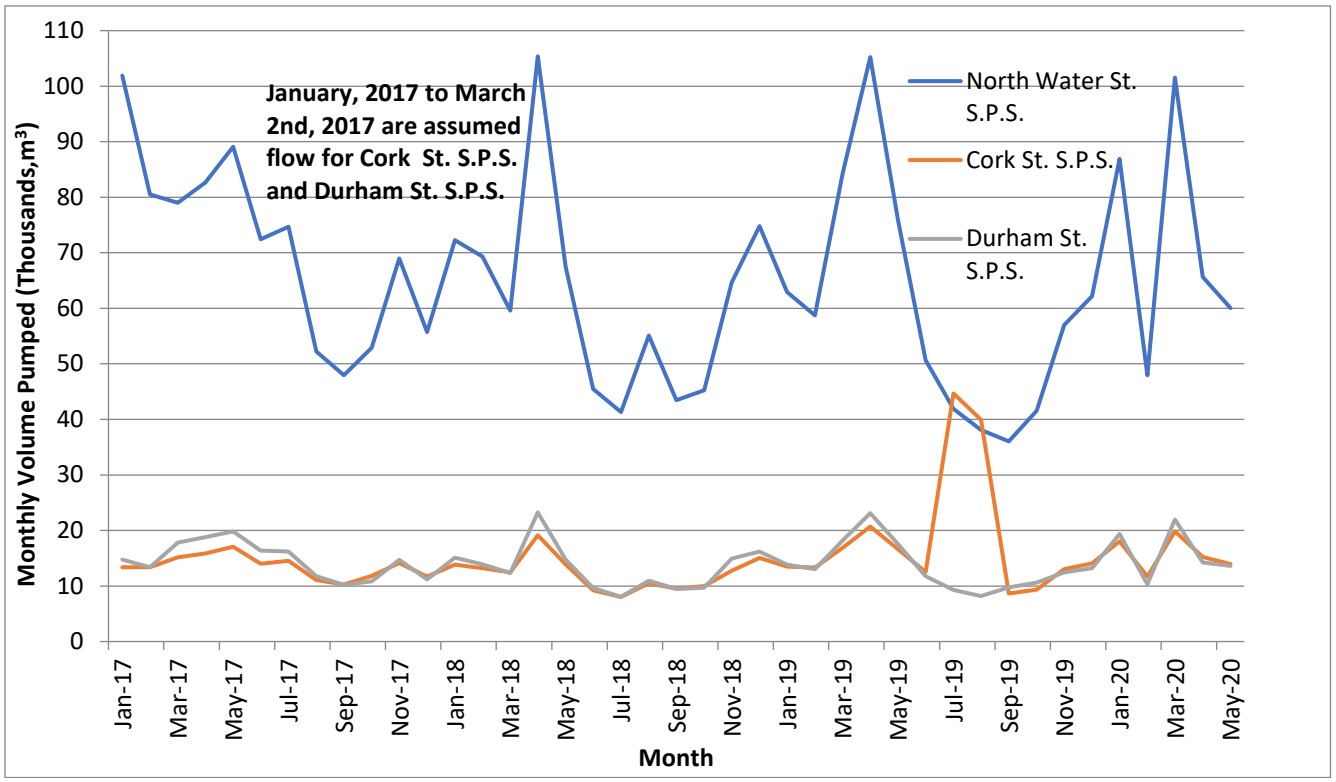


Table 5.2
Annual Average Day Sewage Flow

Year	Population*	Avg. Flow (m^3/d)	Per Capita (Lpcd)
2017	4,785	2,351	491
2018	4,832	2,039	422
2019	4,914	1,957	398
Average			437
*As per annual sewage reserve capacity calculations			

Figure 5.2
Sewage Pumping Station Monthly Flow



Note: It is evident the July and August 2019, Cork Street SPS data is suspect and should be ignored

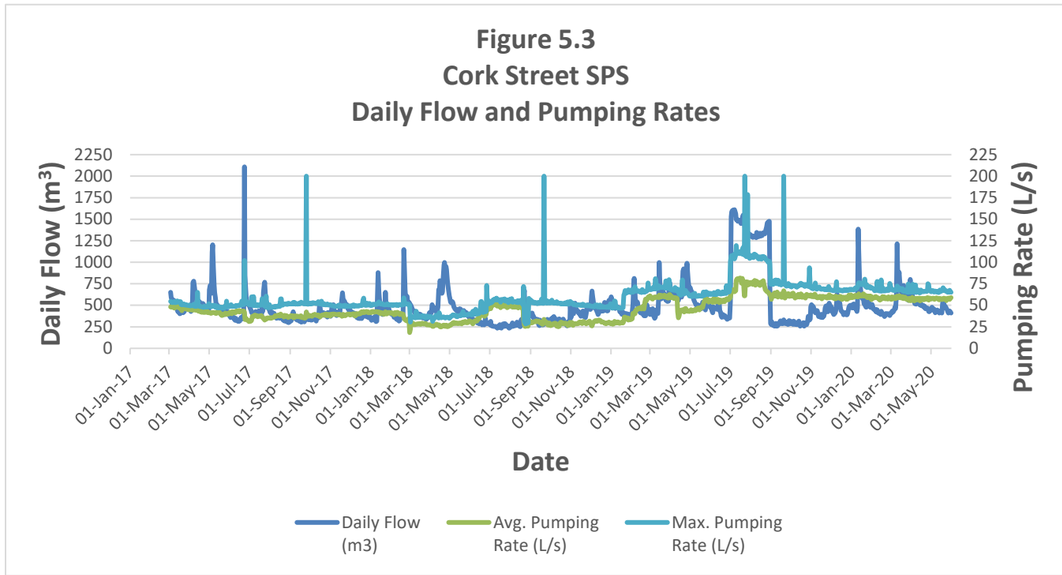
The 3-year average per capita flow is calculated to be 437 Lpcd. Therefore, the historic use of an average 450 Lpcd sewage flow rate appears to be appropriate in terms of annual average sewage flow to the WWTP. However, the design of the collection system (sewers and pumping stations) needs to consider peak instantaneous sewage flows, to avoid sewer backups into buildings and, as much as possible, raw sewage spills to the natural environment. All major SPS facilities are equipped with overflows.

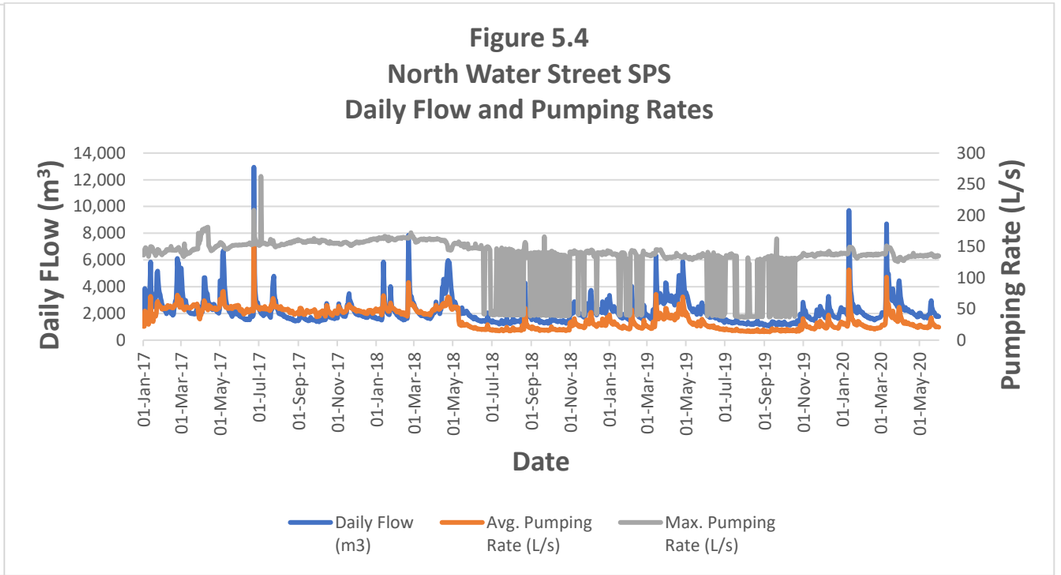
In 2019, the lowest month flow was in September, with the minimum 7-day average daily flow being 1,098 m^3. Using the 2019 reserve capacity population, this is equivalent to approximately 223 Lpcd. Therefore, base sewage flows for the community could be assumed to be in the order of this amount, and the additional flows during other times of the year due to I&I or seasonal changes in water use. In comparison to the established 275 Lpcd design water use demand, the base sewage flow is in the order of 80% of the water use. In 2019, the maximum day sewage flow was in the order of six (6) times higher than this low flow period, and that maximum day flow occurred in March, presumably during a significant wet weather event (e.g. snow melt and rainfall). This high peak flow rate is an indication of high I&I contributions to the sewage collection system. During the past 3 years, the daily sewage flow has ranged from 1,056 to 12,941 m^3/d, further support of high I&I contributions, and making it difficult to predict peak sewage flows for the pumping stations.

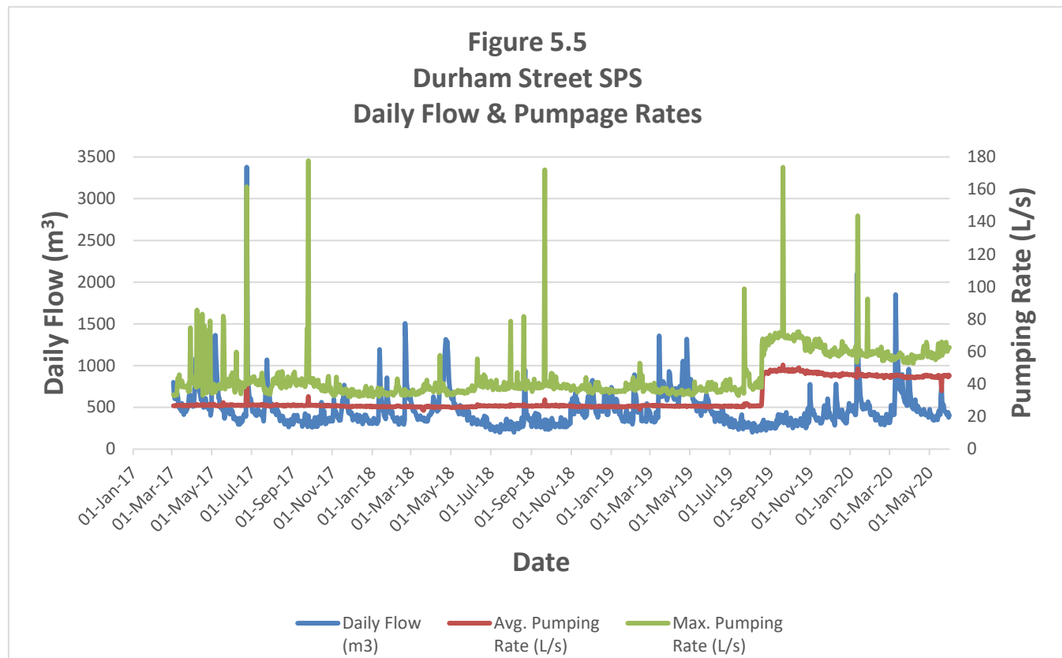
On June 23, 2017, there was a significant rainfall event that resulted in a recorded total daily pumped flow of 12,941 m^3 and a maximum pumping rate of 208L/s, at the NWS-SPS, which is expected to be the actual peak pumping capacity of this station (based on how this station is currently configured and equipped) and, hence, it exceeded the 15,000 m^3/d (173.6 L/s) design hydraulic capacity of the WWTP (although we are not aware of this resulting in any reported malfunctions at the WWTP). The peak sewage inflow to the NWS-SPS is unknown, but is >208L/s. The previous day flow was 1,875 m^3, so there was a 690% increase in the daily flow because of that storm. A comparison of all three key SPSs is provided below in Table 5.3 (may indicate the Durham Street SPS catchment has a higher relative inflow issue than the other catchments, but all catchments have inflow issues). It is evident there are significant sources of inflow to the sanitary collection system during storm and snow melt events, as can be seen in the following charts that show other smaller peaks, as well as infiltration evidenced by longer duration higher-than-average flow periods. This Technical Update study did not evaluate I&I issues, and the sizing of sewer extensions in this study are based on typical design values used by the Township for new sewers.

Table 5.3
Wet Weather Event Flows (June 23, 2017)

Station	Daily Flow (m3)		% increase in flow
	June 22, 2017	June 23, 2017	
Cork Street SPS	390	2,108	540%
Durham Street SPS	392	3,378	860%
Gravity (calculated)	1,093	7,455	680%
North Water Street SPS	1,875	12,941	690%







<u>1. Cork St SPS:</u> probable recirculation of sewage in mid-2019 as evident by high sustained average daily flows? Mode of pump operation may have changed during some periods as evidenced by higher average daily pumping rates. A number of single random 200L/s maximum pumping rates that are suspect.

<u>2. Durham St SPS:</u> apparent change in mode of pump operation beginning in late-2019, as evidenced by higher average day and maximum day pumping rates. A few random occasions of 160-180L/s maximum pumping rates that are suspect.

<u>3. North Water St SPS:</u> A see-saw pattern of maximum daily pumping rates began in mid-2018 and continued up until October 2019. In addition, beginning in early-May, 2018, there was a drop in the average daily pumping rate and daily flow recordings. These changes were not investigated as part of this study. It may be meter calibration or the mode of pumping was altered.

Sewage by-passing was reported during this event, the first known since the new WWTP became operational in November 2008, and then again on January 11-12, 2020, but only at the NWS-SPS (wet weather event; rapid snow melt and rain) that resulted in high peak flows and an overflow event at the NWS-SPS.

The former aeration and clarifier tanks at the NWS-SPS site are available for emergency storage of excess wet weather event flows (not equalization storage: manual pump-outs after such events), although it is reported that the aeration tankage is typically always "half full" of clean water from groundwater infiltration.

5.2 Sanitary Sewer

The community of Mount Forest is serviced by a sanitary sewage collection pipe network, including a number of SPSs that are detailed in a following section. This Technical Update study generally did not include a review of the condition and capacity of the existing sewer system, including those downstream of future sewer extensions. At the time of any significant development, the capacity of the downstream sanitary sewer and pumping stations should be reviewed, as well as confirming the sizing of sewer extensions shown in this report.

In 2007, a new 600mm dia. sanitary sewer was constructed along Arthur Street to the North Water Street SPS, to help alleviate sewage backups during high I&I events. This appears to have greatly reduced sewage backup problems, but there continues to be I&I issues within the collection system. This Technical Update study did not include an evaluation of those problems nor consider solutions to I&I issues.

There are two existing low-pressure sanitary sewers in the community:

- At the easterly end of Wellington Street East, beyond London Road, to service 5 single family residential lots;
- At the easterly end of Durham Street East, immediately west of London Road, to service two 5-unit townhouse buildings (10 total residential units).

The Township owns and operates the low-pressure collection sewer within the bounds of the road allowance while each private lot is responsible for the ownership and operation of the grinder pumps and discharge line within the bounds of the private lots. Normally, the Township will only approve new developments that are serviced by conventional gravity sewers (and a new SPS, if that is required), but in some circumstances may consider alternative methods of sanitary servicing.

As previously mentioned, there are some areas or lots within the urban boundary that are serviced by individual Class IV sewage disposal (septic) systems, including:

- All areas south/southeast of the South Saugeen River.
- Lots fronting on Queen Street east of Sligo Road and west of Cork Street.
- Residential lots fronting on Sligo Road near Queen Street
- Some William Street lots south of Waterloo Street (there is now a sanitary sewer there to allow for connections).

- Some Wellington Street East lots opposite the fairgrounds (there is a sanitary sewer there to allow for connections).
- Various random lots within the urban boundary.

Where practical, the Township should consider extending sanitary servicing to these areas and encourage connections where there is available municipal servicing.

There are also some lots that are serviced by private grinder pumps, some with discharge lines through private easements to a municipal sanitary sewer (e.g. North Water Street, east of John Street; Victoria Street commercial mall; OPP Station on Main Street).

Sanitary sewer extensions to undeveloped areas within the urban boundary were evaluated in previous studies, and further reviewed as part of this study. A summary of key sanitary sewer extensions evaluated is provided in the following subsections.

Calculations for new trunk sanitary sewer extensions were generally completed in previous studies, and were based on the Township's servicing standards, MECP Guidelines, and the Official Plan greenfield residential density, as follows:

- 40 persons per ha
- 450 Lpcd, for domestic flows
- 28m^3/ha/d, for commercial and industrial flows (i.e. used equivalent of 62 persons/ha)
- 0.15 L/ha/s, for extraneous flow allowance (infiltration)
- Peaking factor: Harmon equation (max. 4.0); note this was used also for ICI areas
- Assume minimum sewer grade as per MECP Guidelines

This is expected to result in conservative sizing estimates for these sewers given actual recorded domestic sewage flows are much lower than 450 Lpcd, and past evaluations of metered ICI uses indicates daily flow rates significantly lower than 28 m^3/ha/d. Therefore, at the time of detailed design, the sizing of sewers should be checked.

Based on preliminary information provided for a 139-unit residential subdivision alongside Cork Street opposite the WWTP, it appears the existing Cork Street sanitary sewer is adequate for conveying that additional sewage to the Cork Street SPS. This will be checked further as part of a detailed review of the development submissions made to the Township.

Consideration could be given to establishing a sanitary collection system model, to help with future development reviews and future assessments of collection system capacities.

Servicing areas east of London Road

It is concluded that the Sligo Road sanitary sewer extension may not be deep enough to service vacant lands that are east of the tributary to Fairbanks Creek (See Appendix H profile), because of the elevation of the stream. Until detailed design is completed for the Sligo Road sanitary sewer, it should be assumed that a new SPS will be required for the area east of the tributary, or

other alternate means of conveying sanitary sewage from that vacant future development land to the Sligo Road sanitary sewer west of the tributary.

Sanitary sewer extension from Sligo Road along London Road (based on the current Sligo Road sanitary sewer concept of 375/250mm dia. sewer extension; see Appendix H profile): Sanitary services on the east side of London Road that are closest to Sligo Road and closest to Wellington Street could be routed under the existing trunk storm sewer, but the remainder of the sanitary services on the east side of the road may need to cross over the trunk storm sewer with resultant sanitary service cover depths of 2.0 to 2.4m. However, some locations closer to Sligo Road, where the services cannot go under the trunk storm sewer, may be as shallow as 1.7m cover. Due to the proximity of the sanitary services to the trunk storm sewer, consideration should be given to insulating them where they cross under or over the trunk storm sewer. Consideration can be given to improve the gravity servicing alternatives by extending the 375mm dia. Sligo Road sewer at minimum grade all the way to and beyond London Road. This could be evaluated further.

The vacant property >75m east of London Road, west of a tributary to Fairbanks Creek, north of Wellington Street East and south of Sligo Road, can be serviced by gravity sewer through an extension of the deep Sligo Road sanitary sewer, but will require up to approximately 1.5m of filling. Servicing of that future development area may require routing the sanitary sewer internally with a connection to the Sligo Road sewer at the Sligo/London Road intersection.

An extension of the Birmingham sanitary sewer to London Road would be a minimum 1.4m shallower than that achieved by an extension of the Sligo Road – London Road sanitary sewer. Therefore, such a Birmingham sewer extension would have limited capability of servicing the adjacent portion of the vacant land east of London Road. The Birmingham sanitary sewer could provide servicing to some frontages along London Road at/near Birmingham Street. It is noted that the west side of London Road, from Wellington Street East to Durham Street, is already or is intended to be serviced by existing or proposed sewers connected to the Wellington Street East sanitary sewer or the future Birmingham Street sanitary sewer extension. Future lots fronting on the east side of London Road between Broomer Crescent and Wellington Street East could be serviced by the existing London Road sanitary sewer that is connected to Wellington Street East sewer, although some would end up being shallow insulated services due to the conflict with the existing trunk storm sewer. The extension of the Birmingham sanitary sewer towards London Road is intended to service a Draft Plan approved subdivision on the north side at London Road, as well as vacant land on either side of this new sewer.

Costing for this study includes the foregoing sewer segments but excludes the cost for sanitary services.

Mount Forest Drive/Irwin Lytle Drive industrial area servicing

To service industrial areas along the undeveloped portion of Mount Forest Drive, an extension of the Irwin Lytle Drive sanitary sewer to the west along a future extension of Mount Forest Drive would be required (currently is private ownership), or else a sewer could be routed to the south

from Mount Forest Drive to Sligo Road through undeveloped property. Portions of the industrial lands north of Wellington Heights Secondary School would require regrading/filling to accommodate gravity servicing, or else sewage pumping will be required. Costing for this study includes this future sewer segment.

Cork Street residential development area south of the Mount Forest Sports Complex

Some preliminary evaluations have been completed recently due to residential development interests on the west side of Cork Street and north side of Martin Street (WWTP driveway). The developer engineer's preliminary evaluation has determined that a SPS will be required to service that property, and that it will discharge to the Cork Street sanitary sewer for conveyance to the Cork Street SPS. Preliminary calculations anticipate there will be sufficient capacity in the existing downstream Cork Street sanitary sewer if this development were serviced by gravity, although it will result in the design flow rate approaching the capacity of that existing sewer. This will require careful evaluation at the time this development proceeds, since the mode of servicing is expected to be by a pumping station. It may be required that the SPS be equipped with low capacity VFD-controlled sewage pumps to minimize peak discharge rates to the existing sewers. This should be reviewed at the time the Developer makes engineering submissions to the Township.

Egremont annexation (zoned for industrial use)

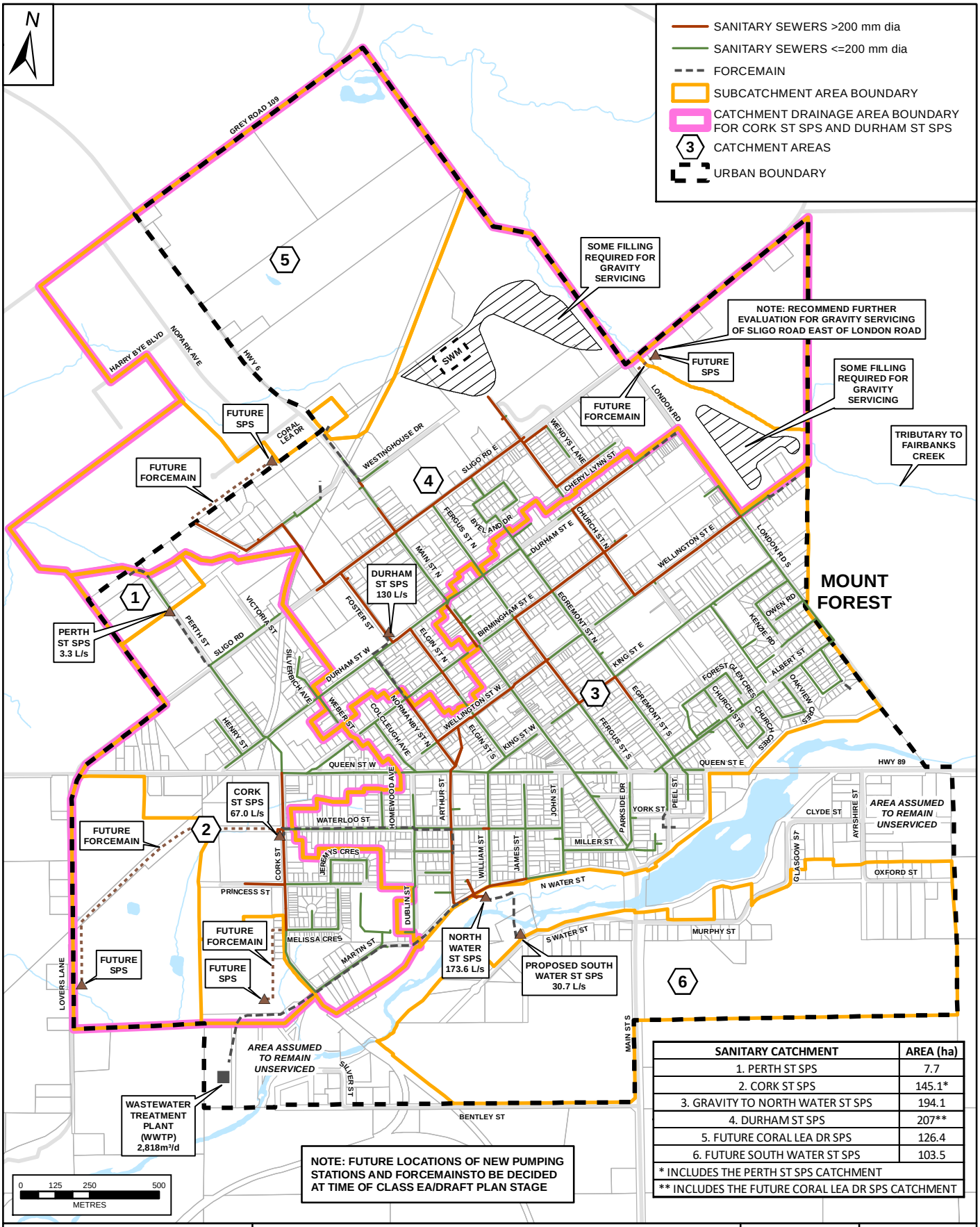
Servicing of this industrial area would require a SPS. Appendix H shows two profiles into this annexation area, one along an imaginary extension of Irwin Lytle Drive and the other along Highway No. 6. Both show that gravity servicing is not an option. The current concept for servicing the Egremont annexation is a SPS located near the intersection of Coral Lea Drive and Nor-Park Drive. The forcemain would discharge to a future extension of the Industrial Drive sanitary sewer. Given there are no active development interests, a more detailed evaluation and costing was not completed as part of this study.

5.3 Sewage Pumping Stations (SPSs)

The community of Mount Forest is serviced by four SPSs, and a fifth SPS has been designed and submitted to MECP for review and approval. It may be constructed as early as 2021 but depends on a Developer's schedule. The design capacity of the Mount Forest SPSs is based on design peak sanitary sewage flow rates. Select capacity and station schematic information is included as Appendix I, for reference. Figure 5.6 depicts the SPS catchment boundaries as well as additional future anticipated pumping station locations.

Perth Street Sewage Pumping Station (SPS)

The Perth Street submersible dual pump SPS was constructed as an interim solution to providing sanitary servicing for an extension of the Perth Street industrial area. It is a manhole located in the center of the street. It has a rated station capacity of 3.3L/s at 35m TDH. It discharges through a 50mm dia. forcemain to the Perth Street sanitary sewer, which conveys sewage to the



SANITARY CATCHMENT	AREA (ha)
1. PERTH ST SPS	7.7
2. CORK ST SPS	145.1*
3. GRAVITY TO NORTH WATER ST SPS	194.1
4. DURHAM ST SPS	207**
5. FUTURE CORAL LEA DR SPS	126.4
6. FUTURE SOUTH WATER ST SPS	103.5
* INCLUDES THE PERTH ST SPS CATCHMENT	
** INCLUDES THE FUTURE CORAL LEA DR SPS CATCHMENT	

NOTE: FUTURE LOCATIONS OF NEW PUMPING STATIONS AND FORCEMAINSTO BE DECIDED AT TIME OF CLASS EA/DRAFT PLAN STAGE

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TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

MUNICIPAL SEWAGE PUMPING STATION CATCHMENT AREAS

DATE JAN. 05, 2021

PROJECT No. 20013

SCALE AS SHOWN

FIGURE No. 5.6

Cork Street SPS. Because it is currently servicing only dry industries, the sewage flow rate to this station is anticipated to be very low and well below its rated capacity. This is confirmed by the consistent low pump hours, with the current annual average being 1.3hrs/day (see Appendix J)

Cork Street Sewage Pumping Station (SPS)

A new Cork Street submersible VFD-controlled dual pump SPS was constructed in 2010 at the southwesterly corner of the Cork/Waterloo Street intersection. It has a rated capacity of 67L/s at 24.3m TDH. It discharges through a 200-250mm dia. forcemain along Waterloo Street to the Arthur Street sanitary sewer, where it is then conveyed to the NWS-SPS. This station was sized to accommodate pumps with an ultimate capacity of 97L/s. The facility is equipped with a 175-kW standby diesel generator set.

Based on a review of sewage flows for the period of 2017-2019, the following is noted **(Note: the July & August 2019, recorded data, and four random 200 L/s recorded peak flows, were ignored in the evaluation of this station – data suspect):**

- Minimum of 235 m3/day (July 18, 2018)
- Maximum of 2,108 m3/day (June 23, 2017, coinciding with a significant rainfall event)
- A significant user was added to the catchment in 2018, that being the new Saugeen Valley Nursing Centre.
- On January 20, 2019, there was a noticeable increase in the pumping rate, by about 35%, and this appears to have been sustained. However, there does not appear to be a significant increase in the annual average day flow during the 3-year period. This may indicate there was an operational change made at this station.
- 99^{th} percentile peak instantaneous pumping rate was 58.5-60.7 L/s in 2017 to early-January 2019, and after January 20, 2019, it has been 79.5 L/s. This further indicates there was an unknown significant change in this pumping station's operations.
- The apparent 2019 peak pumping rate (and hence the assumed peak sewage inflow rate) exceeds the rated design capacity of 67 L/s. However, based on pre-2019 data, there may be 6.3L/s or more of reserve capacity.
- **At this time additional data and evaluation are required before the peak sewage inflow rate can be established and compared to its equipped capacity.**
- There is a current development interest within the Cork Street SPS catchment (i.e. a 139-unit residential subdivision), so resolution of its current operations and capacity will become more important. Preliminary information received for that development indicates the peak sewage flow rate will be 9.6L/s (if using 450Lpcd and peaking factor of 4.0), which may result in the total peak sewage flow to the Cork Street SPS being exceeded and, therefore, may require upgrading of the pumps prior to full build-out of that new subdivision.

Although it is expected that the Cork Street SPS has surplus capacity (excluding consideration of extreme wet weather events), this could not be established based on a review of available data. **We therefore recommend the Township complete a more comprehensive evaluation of flows at the Cork Street SPS, to determine the cause of the apparent significant increase in peak pumping rates that began in January 2019 and to establish what the actual peak sewage inflow rate is**. If peak flows are confirmed to be more than the approved rated station capacity of 67 L/s, or if the addition of the proposed new subdivision will increase the peak flow to greater than the station's capacity, then the Township should proceed to upgrade the pumps and, possibly, the forcemain. As applicable, costing should then be prepared for this upgrading work.

A preliminary pumping station reserve capacity calculation table is included as Appendix K.

Durham Street Sewage Pumping Station (SPS)

A new SPS was constructed in 2011 at the north-easterly corner of Durham/Foster Street. It continues to be known as the Durham Street SPS. It is equipped with three pumps, each with a rated capacity of 74L/s at 13m TDH. It discharges through a 300mm dia. forcemain to a 600mm dia. sanitary sewer on Normanby Street, where it is then conveyed by gravity to the NWS-SPS. The Durham Street SPS was designed for parallel pump operation, and the currently equipped dual pump operational rated capacity is approximately 130L/s. The station wetwell was sized to accommodate an ultimate total capacity of 251 L/s. The facility is equipped with a 60-kW standby diesel generator set.

Based on a review of sewage flows for the period of 2017-2019, the following is noted:

- Minimum of 201 m3/day (August 5, 2018)
- Maximum of 3,378 m3/day (June 23, 2017, coinciding with a significant rainfall event)
- The currently equipped station capacity is rated at 130 L/s (2 of 3 pumps operating in parallel).
- 99th percentile peak instantaneous pumping rate of 78.9 L/s (i.e. the assumed peak sewage inflow rate).
- Therefore, there is a minimum surplus of 51.1 L/s, based on the 99th percentile.
- If use 450 Lpcd and a peaking factor of 4.0 for growth in peak sewage flow, this is equal to 0.0208 L/s per capita
- Therefore, a surplus of 51.1 L/s is equivalent to an increased population of 2,456. If all the growth occurred in this catchment, the surplus capacity may be exhausted by as early as **Yr. 2036** according to the Growth Plan projections of growth (see Section 4.4 table). However, given some of the growth is expected in other catchments, it is anticipated that the current Durham Street SPS capacity, as currently equipped, is sufficient for beyond the 20-year planning period (i.e. **beyond 2040**).

Based on the foregoing evaluation, there is no need to increase the equipped capacity for the Durham Street SPS within the next 20-year planning period. Therefore, no costing has been included in this study for upgrades to this station.

A pumping station reserve capacity calculation table is included as Appendix K.

North Water Street Sewage Pumping Station (NWS-SPS)

The old WWTP was converted into a Main SPS at the time the current new WWTP was commissioned in November 2008. All sanitary sewage flow from the serviced areas of the community ends up at the North Water Street SPS, including from all other SPSs, where it is then (re)pumped to the WWTP through a 300 mm diameter forcemain along North Water Street and Martin Street. This station is equipped with 2 variable speed pumps, each rated to handle a flow of 173.6 L/s at 44.2 m TDH and 1 pump rated for 57.2 L/s at 17.7 m TDH. Only 1 pump was designed to operate at any given time. The facility is equipped with a 450-kW standby diesel generator set. There is approximately 1,288 m^3 of storage at the SPS which is used to store excess peak flows during emergency wet weather events.

Based on a review of sewage flows for the period of 2017-2019, the following is noted:

- Minimum of 1,056 m^3/day (September 11, 2019)
- Maximum of 12,941 m^3/day (June 23, 2017, coinciding with a significant rainfall event)
- 99th percentile peak instantaneous pumping rate of 175.4 L/s (it is noted that, other than the June 23, 2017, significant rainfall event, all peak pumping rates above the 99th percentile occurred in April 2017; the exact cause of this is unknown).
- 95th percentile peak pumping rate was 162.9 L/s.
- Apparent peak pumping capacity is 208.3 L/s (based on June 23, 2017 peak pumping rate; note that this station and the WWTP design hydraulic capacity is 173.6 L/s).
- Therefore, there is a minimum surplus of 32.9L/s, based on the 99th percentile (45.4 L/s, if basing it on the 95th percentile), based on the apparent actual equipped capacity of the station. We are not aware of any reported problems at the WWTP when accepting these high wet weather event flows, but there was tertiary bypassing at the WWTP at the time of the June 23, 2017, wet weather event but none at the time of the January 2020 NWS-SPS bypassing event.
- However, there is a flushing cycle to exercise the large pumps to help keep the forcemain clean. This information would need to be obtained and reviewed in order to refine the evaluation of the supplied and supplemental sewage pumping data, to better establish sewage peak inflow rates.
- The Cork Street SPS and Durham Street SPS discharges, upstream of the North Water Street SPS trunk inlet sewer, will impact the peak flows entering this station.
- If use 450 Lpcd and a peaking factor of 4.0 for growth in peak sewage flow, this is equal to 0.0208 L/s per capita (ignores extraneous flow allowance of 0.15L/s/ha).
- Therefore, a surplus of 32.9 L/s is equivalent to an increased population of 1,581, which may be realized **by Yr. 2031** according to the Growth Plan projections (see Section 4.4 table). If using 45.4 L/s (95th percentile), this becomes a population of 2,182 and Yr. 2034.
- It is noted this 1,581 population is close to the calculated reserve capacity additional population of 1,621, though it was based on a slightly lower per capita sewage flow of 430 Lpcd. **This indicates the WWTP and NWS-SPS capacities will probably need to**

be simultaneously expanded, to accommodate growth, by Yr. 2031 or earlier. This assumption is subject to more detailed review of how the large sewage pumps are being operated in conjunction with the foregoing evaluation of the peak pumping rate.

- In addition to the leachate co-treatment feasibility study, the Township should begin planning for the expansion of its sewage treatment capacity, which should include a more detailed review of the pumping capacity at the NWS-SPS. Typically, the low normal duty sewage pump would be upgraded but not the larger pumps which are designed for more severe conditions such as wet weather events.
- It is further noted that 208.3 L/s is not the approved hydraulic design capacity of the WWTP. The foregoing calculations are based on how the existing NWS-SPS appears to be currently equipped and the resultant additional population that can be accommodated for 99% of the time without causing an exceedance of this equipped pumping capacity.

Based on the foregoing evaluation, it is recommended that the NWS-SPS and the WWTP be further evaluated to establish the actual non-wet weather event peak flow rate, and to confirm the WWTP can hydraulically and biologically accept the high flow periods. There may then be a need for planning to increase the ability to manage increasing sewage flows at the NWS-SPS within the next 20-year planning period and, preferably, well in advance of Yr. 2031, which may be advanced if co-treatment of leachate will proceed. This evaluation needs to consider the existing forcemain capacity. Further, any consideration for expanding the NWS-SPS capacity may require an expansion of the WWTP capacity or provision for equalization storage. Measures to reduce I&I flows could be considered. However, extreme wet weather event flows are difficult to manage, and the occasional by-passing can be expected to continue to occur during extreme weather events.

A preliminary pumping station reserve capacity calculation table is included as Appendix K.

South Water Street Sewage Pumping Station (SWS-SPS)

Works were constructed across the South Saugeen River in 2005, from the NWS-SPS to the future location of a SWS-SPS: forcemain; electrical conduits.

SWS-SPS design work has been completed and an ECA received from MECP. These works could proceed to tendering and construction, upon completion of final electrical design. At this time, it is anticipated that servicing for Phase 1 of the Avila Subdivision will commence as early as 2021 and that the SWS-SPS would be constructed as early as 2021.

Future pumping stations

The following are anticipated future SPSs that will be needed at the time of future development:

- Cork Street residential development north of the WWTP.
- Coral Lea Drive SPS, to service the Egremont annexation industrial area, and if applicable to service West Grey's industrial park. Due to limited capacity of the existing Industrial Drive sanitary sewer, and depending on the actual sewage generation rates of industries within the West Grey industrial park and future development within the

Egremont annexation lands, it may be necessary to route the forcemain from this future SPS to Foster Street and/or a combination of forcemain and new gravity sanitary sewer.

- Sligo Road East SPS, to service the vacant land area that is east of London Road and east of a tributary to Fairbanks Creek. It appears the capacity of a Sligo Road sanitary sewer extension could provide a suitable outlet for this future station. It is noted that there may be the possibility of gravity servicing (crossing of the tributary to Fairbanks Creek), but that would require completion of some survey and preliminary design work to confirm.
- Lover's Lane SPS, to service vacant land area in this southwesterly corner of the urban area including along Sligo Road in the vicinity of Queen Street East. Existing Cork Street sanitary sewer capacity, from Queen Street to the Cork Street SPS, is anticipated to be insufficient to service all of Lover's Lane catchment sewage flows. A forcemain from such a future SPS may need to be routed to and through the Cork Street Recreation Park to the Cork Street SPS for conveyance of those flows. As noted earlier in this report, the ultimate capacity of the Cork Street SPS should be reviewed based on recent apparent high peak flows to that station which are not understood.
- Clyde Street SPS, if it is ever desired to service the low-density residential development in the Ayrshire-Clyde-Glasgow Street area. Where such sewage could be conveyed was not evaluated.
- Silver-Mill Street SPS, if it is ever desired to service the low-density residential development in this area that is northwest of Bentley Street. Where such sewage could be conveyed was not evaluated.

An evaluation of the locations of such future SPSs was not part of this study nor provision of costing

It is assumed that the following areas will be regraded and filled to allow for gravity sanitary sewer servicing through extensions of the existing sanitary collection system:

- Industrial area north of Wellington Heights Secondary School. A portion of this area can be serviced by gravity sewer, but much of it would require some filling with some areas, in particular the north-easterly portion, needing more than 2m of fill. It is noted that sanitary sewer in an industrial area typically does not require basement servicing and therefore shallower sanitary sewers could be constructed, but this will not alter the need for some relatively extensive filling in some areas of this parcel of land. It may be that some portions of this industrial area will be serviced by private pumping stations.
- Vacant land area that is beyond and to the east of London Road and adjacent to and west of the tributary to Fairbanks Creek can be serviced by an extension of the Sligo Road sanitary sewer if up to approximately 1.5m of fill is utilized.

5.4 Waste Water Treatment Plant (WWTP)

The new Mount Forest Sewage Treatment Plant is located on Martin Street west of Cork Street. It has an approved annual average day treatment capacity of 2,818 m3/d. It has an approved hydraulic peak flow capacity of 15,000 m3/d. Upon completing a receiver impact study to the

satisfaction of MECP, the WWTP may be re-rated to an approved capacity of 3,500m3 without the need for a physical expansion.

Although not part of this Technical Update study, some comments on WWTP treatment capacity are provided based on the current approved WWTP treatment capacity and using the information presented by others in their 2020 reserve capacity calculations (see Appendix K), as follows:

- 4,914 population currently serviced (recall, a few areas in the community are not serviced by the municipal sewage system).
- 1,621 additional population that can be serviced (based on 430Lpcd).
- **6,535** total population that can be serviced.
- Growth Plan used 2.27% growth rate, to Yr. 2036.
- Assume all growth will be serviced by the municipal sewage works, and that no existing built unserviced areas will be added to the serviced area.
- Therefore, the following table provides a projection of the future population serviced by the municipal sewage system

Year	Growth	Serviced Pop'ln
2019		4914
2020	126	5040
2021	129	5169
2022	132	5301
2023	135	5436
2024	138	5574
2025	141	5715
2026	144	5860
2027	148	6007
2028	151	6158
2029	154	6313
2030	158	6471
2031	162	**6632**
2032	165	6798
2033	169	6967
2034	173	7140
2035	177	7316
2036	181	7497

- Therefore, the WWTP capacity can be expected to be exhausted **by Yr. 2031 or earlier**.
- It is noted that some of the WWTP capacity may end up being utilized for the co-treatment of leachate from the Riverstown Waste Facility. A feasibility study is currently being completed by the Township to determine the impacts and acceptability of co-treatment. This may advance the utilization of the remaining WWTP capacity.

- A new South Water Street SPS may be constructed as early as Yr. 2021, to service the Avila subdivision. That would result in the ability to service some existing residents along South Water Street, which would increase the utilization of the uncommitted reserve capacity and advance the date when the WWTP capacity will be fully utilized.

It is recommended that the Township proceed with completing the Receiver Impact Assessment and getting approval of the increased 3,500m^3/day WWTP capacity.

The Township could consider stress testing the WWTP to help support an application to increase the rated capacity of the plant.

5.5 Recommended Sewage Works Projects

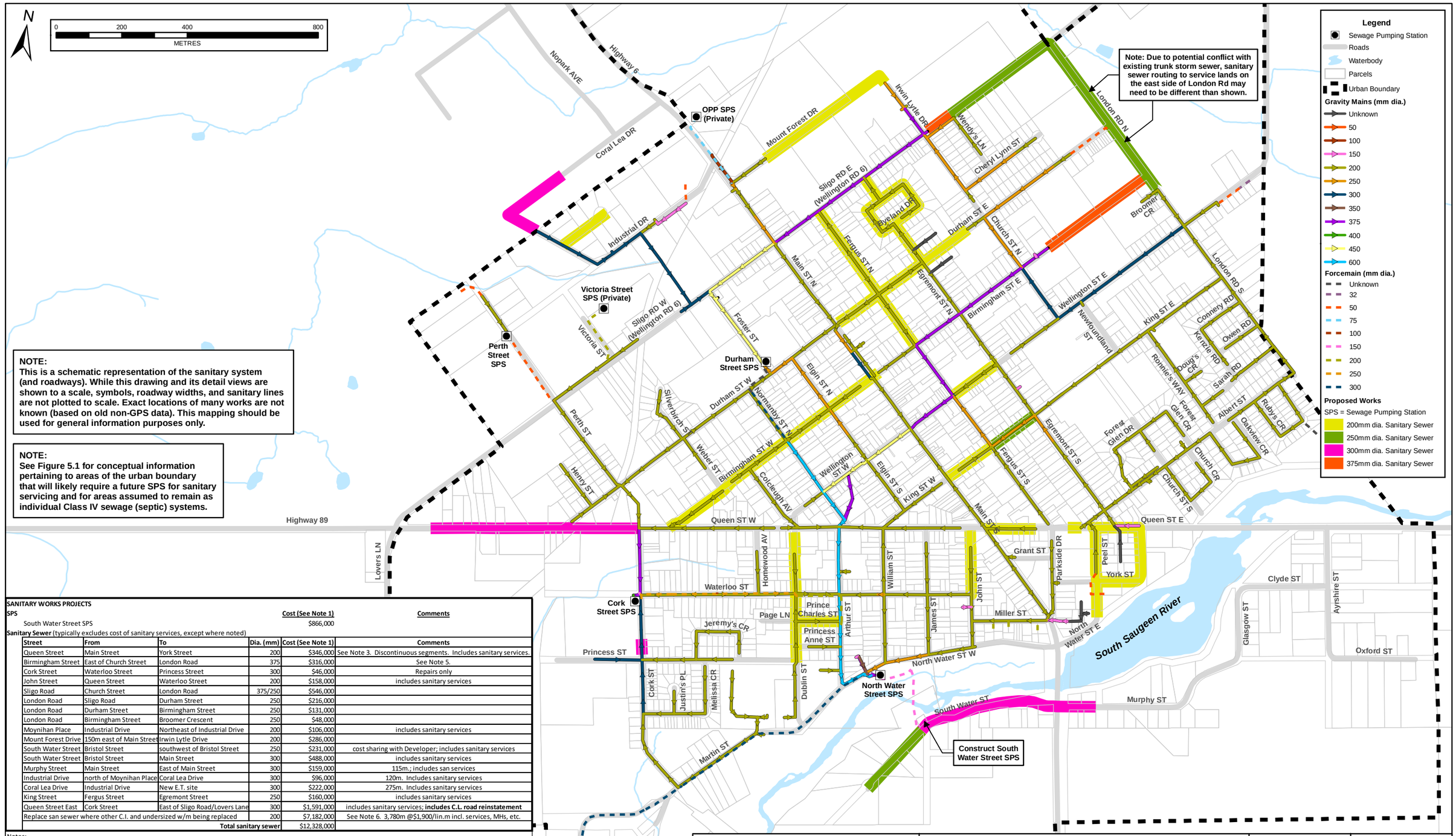
Based on the scoped study evaluations completed, the following Sewage Collection System projects are anticipated during the next 20-year planning period:

1. Complete the WWTP Receiver Impact Assessment and obtain approval for increasing the operational capacity of that plant to 3,500m3/day.
2. The conclusions presented in this report regarding the Cork Street SPS are inconclusive. Additional evaluation should be completed as recommended in Section 5.3, to establish the actual peak sewage inflow rate and reserve pumping capacity. Upon completion of that additional study work, the recommendations presented in this report for the Cork Street SPS should be reviewed and refined. Based on preliminary peak sewage flow information for a proposed 139-unit residential subdivision adjacent to Cork Street, it may be necessary to upgrade the Cork Street pumps prior to full build-out of that subdivision.
3. The conclusions presented in this report regarding the North Water Street SPS are inconclusive. Additional evaluation, in concert with the WWTP capacity, should be completed as recommended in Section 5.3. Upon completion of that additional study work, the recommendations presented in this report for NWS-SPS should be reviewed and refined.
4. Prior to proceeding with any easterly extension of the Sligo Road sanitary sewer, complete survey and evaluate the possibility of gravity servicing east past the tributary to Fairbanks Creek.
5. Replace the 200mm dia. sanitary sewer on John Street, from Waterloo Street to Queen Street, as part of a street reconstruction project.
6. Construct 200mm dia. sanitary sewer on future Moynihan Place located within the existing Industrial Drive area, to service new industrial lots.
7. Extend the 300mm dia. Industrial Drive sanitary sewer, from Moynihan Place to Coral Lea Drive, and along Coral Lea Drive to the new elevated water storage tank (if this is the selected storage alternative), to service new industrial lots.
8. Extend the Birmingham Street sanitary sewer to London Road, depending on Developer schedule. This work will probably be completed by interested developers. The size of the sewer should be evaluated.

9. Replace and extend Queen Street 200mm dia. sanitary sewer, from Main Street to York Street, as part of a future MTO Highway Connecting Link funded project (road items would be eligible for MTO funding, but not the sanitary sewer).
10. Repair the existing sanitary sewer on Cork Street, north of Princess Street.
11. Construct the new South Water Street SPS (SWS-SPS), dependent on Developer schedules.
12. As part of Phase 1 of the Avila subdivision, construct a 250mm dia. sanitary sewer complete with services on South Water Street, from the SWS-SPS site southwesterly past the westerly end of the existing street and into the subdivision lands. This work is to be completed by the Developer. There may be some cost sharing with the Township.
13. Continue replacing old sanitary sewers in concert with cast iron and small diameter (<150mm) watermain replacement activities, typically as part of progressively completing street reconstruction within the community, or in accordance with other priorities.

Recommended works are presented on Figure 5.7, along with costs (see also Appendix E).

Other sanitary collection system works identified in this report should be completed as development interests dictate. At this time, they are not included in the recommendations since there are no known current active development interests.



NOTE:
This is a schematic representation of the sanitary system (and roadways). While this drawing and its detail views are shown to a scale, symbols, roadway widths, and sanitary lines are not plotted to scale. Exact locations of many works are not known (based on old non-GPS data). This mapping should be used for general information purposes only.

NOTE:
See Figure 5.1 for conceptual information pertaining to areas of the urban boundary that will likely require a future SPS for sanitary servicing and for areas assumed to remain as individual Class IV sewage (septic) systems.

SANITARY WORKS PROJECTS

SPS

	Cost (See Note 1)	Comments
South Water Street SPS	$866,000	

Sanitary Sewer (typically excludes cost of sanitary services, except where noted)

Street	From	To	Dia. (mm)	Cost (See Note 1)	Comments
Queen Street	Main Street	York Street	200	$346,000	See Note 3. Discontinuous segments. Includes sanitary services.
Birmingham Street	East of Church Street	London Road	375	$316,000	See Note 5.
Cork Street	Waterloo Street	Princess Street	300	$46,000	Repairs only
John Street	Queen Street	Waterloo Street	200	$158,000	includes sanitary services
Sligo Road	Church Street	London Road	375/250	$546,000	
London Road	Sligo Road	Durham Street	250	$216,000	
London Road	Durham Street	Birmingham Street	250	$131,000	
London Road	Birmingham Street	Broomer Crescent	250	$48,000	
Moynihan Place	Industrial Drive	Northeast of Industrial Drive	200	$106,000	includes sanitary services
Mount Forest Drive	150m east of Main Street	Irwin Lytle Drive	200	$286,000	
South Water Street	Bristol Street	southwest of Bristol Street	250	$231,000	cost sharing with Developer; includes sanitary services
South Water Street	Bristol Street	Main Street	300	$488,000	includes sanitary services
Murphy Street	Main Street	East of Main Street	300	$159,000	115m.; includes san services
Industrial Drive	north of Moynihan Place	Coral Lea Drive	300	$96,000	120m. Includes sanitary services
Coral Lea Drive	Industrial Drive	New E.T. site	300	$222,000	275m. Includes sanitary services
King Street	Fergus Street	Egremont Street	250	$160,000	includes sanitary services
Queen Street East	Cork Street	East of Sligo Road/Lovers Lane	300	$1,591,000	includes sanitary services; **includes C.L. road reinstatement**
Replace san sewer where other C.I. and undersized w/m being replaced			200	$7,182,000	See Note 6. 3,780m @$1,900/lin.m incl. services, MHs, etc.
		Total sanitary sewer		$12,328,000	

Notes:
1. Above are Class 5 present value opinions of probable cost generally based on limited information, and includes construction, engineering and net HST (1.76%)
2. Above excludes Yr. 2020 active construction projects
3. Queen Street East costs assume works will be completed as part of a 90% Connecting Link grant and, therefore, eligible MTO portion of road reinstatement costs are excluded.
4. Above costs only include trench restoration and do not include any new roads or upgrades to existing roads.
5. 375mm dia. as per the previous Master Plan study. Based on the probable revised extent of the catchment area, the size of sewer can probably be reduced.
6. These segments are: Birmingham Street, From Queen Street to east side of Main Street; Byeland Drive; Durham Street, from Main Street to 140m east of Egremont Street; Egremont Street, from Byeland Drive to Durham Street; Fergus Street, from Sligo Road to Birmingham Street; Wellington Street, from Fergus Street to Egremont Street; King Street, from Main Street to Fergus Street; Dublin Street, from Queen Street to Princess Street; Prince Charles Street; Peel Street; York Street.

BMROSS engineering better communities

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST

SANITARY AND WATER SERVICING TECHNICAL UPDATE

PROPOSED SANITARY WORKS

DATE
DEC. 11, 2020

PROJECT No.
20013

SCALE
AS SHOWN

FIGURE No.
5.7

6.0 PROJECT LIST AND PROBABLE COSTS

The capital projects summarized in Figure 4.6 and Figure 5.7, along with costs, are anticipated to be completed within the next twenty-year period, but many are development driven. These capital projects focussed on growth Stages 2 & 3, although consideration was given to capital servicing needs within the existing built area (Stage 1; mostly reconstruction of aging infrastructure).

7.0 APPROVALS

The following agency consultation or approvals activities are anticipated:

- Schedule B Class EA for a new elevated water storage facility
- Planning issues would need to be addressed for any new water storage facility located beyond the existing urban boundary and within an adjacent municipality.
- MECP approvals (ECA) would be required for the new elevated water storage facility.
- Works that will occur within a Regulated Area or across streams will require a Permit from SVCA
- Sewage Works (sanitary sewer; SPS capacity changes) require an ECA from MECP.
- Source Water Protection issues may need to be addressed for some of the recommended projects. The local Risk Advisor should be consulted.

Record of Watermains Form 1 would need to be completed for any new watermains.

It is noted that there are potential changes coming to linear infrastructure ECA's that would avoid individual ECA application submissions to MECP for certain limited types of works.

8.0 RECOMMENDATIONS

The following recommendations are made in relation to the results of this Mount Forest servicing technical update:

1. Complete water works capital upgrades as presented in Section 4.5 and as summarized in Figure 4.6.
2. Complete sewage works study and capital upgrade work as presented in Section 5.5 and as summarized in Figure 5.7.

Further, consideration could be given to making further progress on improving the Township's GIS database (e.g. mapping of easements; showing areas where properties are still serviced using septic systems; linkage to As Recorded drawings and service record sheets).

It is noted that Regulatory changes can alter the conclusions and recommendations of this report. For example, if drinking water quality limits become more stringent (e.g. sodium levels in Well 5), it may become necessary to implement additional treatment processes or to establish a new well supply. This would also apply to regulations for waste water treatment plant effluent limits

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED

Per _____
Frank Vanderloo, P. Eng.

:klt

APPENDIX A

GROWTH PLAN MAPPING

(Yr. 2017)

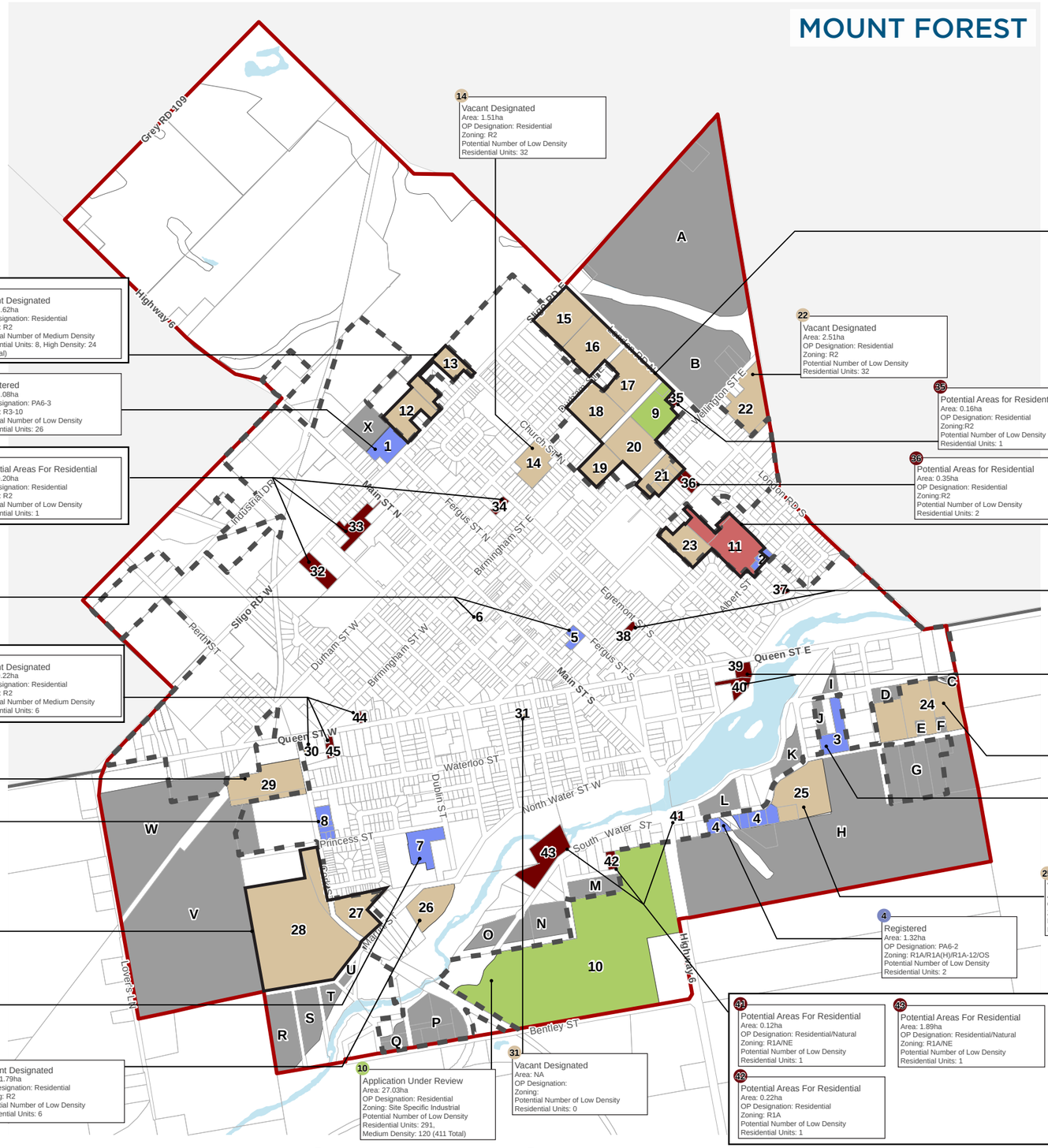
ACTIVE AND PENDING DEVELOPMENT

(As of December 2020)

MOUNT FOREST

Development Status

- Application-under-review
- Draft-Approved-or-Provisional
- Registered
- Vacant-Designated
- Built Boundary
- Settlement Boundary
- Potential Areas for Resdiential
- Future Development Designation



14 Vacant Designated
Area: 1.51ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 32

12 Vacant Designated
Area: 1.77ha
OP Designation: Residential
Zoning:R2
Potential Number of Low Density
Residential Units: 26

13 Vacant Designated
Area: 1.62ha
OP Designation: Residential
Zoning: R2
Potential Number of Medium Density
Residential Units: 8, High Density: 24
(32 Total)

1 Registered
Area: 1.08ha
OP Designation: PA6-3
Zoning: R3-10
Potential Number of Low Density
Residential Units: 26

32 Potential Areas For Residential
Area: 0.78ha
OP Designation: Industrial
Zoning: M1
Potential Number of Medium Density
Residential Units: 20

32 Potential Areas For Residential
Area: 0.98ha
OP Designation: Res Transition/Industrial
Zoning: R2/M1/MU2
Potential Number of Medium Density
Residential Units: 24

34 Potential Areas For Residential
Area: 0.20ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 1

5 Registered
Area: 0.35ha
OP Designation: Residential
Zoning: R3-7, MU1
Potential Number of High Density
Residential Units: 30

6 Registered
Area: NA
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 16

30 Vacant Designated
Area: 0.14ha
OP Designation: Residential
Zoning: R
Potential Number of Low Density
Residential Units: 4

44 Vacant Designated
Area: 0.08ha
OP Designation: Residential
Zoning: R1B
Potential Number of Low Density
Residential Units: 1

45 Vacant Designated
Area: 0.22ha
OP Designation: Residential
Zoning: R2
Potential Number of Medium Density
Residential Units: 6

29 Vacant Designated
Area: 3.37ha
OP Designation: Residential
Zoning: M1
Potential Number of Medium Density
Residential Units: 4

8 Registered
Area: 0.68ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 6

27 Vacant Designated
Area: 1.89ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 3, Medium Denisty: 8
(11 Total)

28 Vacant Designated
Area: 12.89ha
OP Designation: Residential
Zoning: FD
Potential Number of Low Density
Residential Units: 122, Medium Density: 83
(205 Total)

7 Registered
Area: 1.33ha
OP Designation: Residential
Zoning: IN-37(H)
Potential Number of Medium Density
Residential Units: 15

26 Vacant Designated
Area: 1.79ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 6

10 Application Under Review
Area: 27.03ha
OP Designation: Residential
Zoning: Site Specific Industrial
Potential Number of Low Density
Residential Units: 291,
Medium Density: 120 (411 Total)

31 Vacant Designated
Area: NA
OP Designation:
Zoning:
Potential Number of Low Density
Residential Units: 0

22 Vacant Designated
Area: 2.51ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 32

35 Potential Areas for Residential
Area: 0.16ha
OP Designation: Residential
Zoning:R2
Potential Number of Low Density
Residential Units: 1

36 Potential Areas for Residential
Area: 0.35ha
OP Designation: Residential
Zoning:R2
Potential Number of Low Density
Residential Units: 2

37 Potential Areas For Residential
Area: 0.10ha
OP Designation: Residential
Zoning: R1C
Potential Number of Low Density
Residential Units: 1

38 Potential Areas For Residential
Area: 0.18ha
OP Designation: Residential
Zoning: R2
Potential Number of Medium Density
Residential Units: 1

39 Potential Areas For Residential
Area: 0.33ha
OP Designation: Residential/Natural
Zoning: R3-30
Potential Number of Medium Density
Residential Units: 4

40 Potential Areas For Residential
Area: 0.50ha
OP Designation: Residential/Natural
Zoning: R3-30
Potential Number of Medium Density
Residential Units: 4

41 Potential Areas For Residential
Area: 0.12ha
OP Designation: Residential/Natural
Zoning: R1A/NE
Potential Number of Low Density
Residential Units: 1

42 Potential Areas For Residential
Area: 1.89ha
OP Designation: Residential/Natural
Zoning: R1A/NE
Potential Number of Low Density
Residential Units: 1

42 Potential Areas For Residential
Area: 0.22ha
OP Designation: Residential
Zoning: R1A
Potential Number of Low Density
Residential Units: 1

4 Registered
Area: 1.32ha
OP Designation: PA6-2
Zoning: R1A/R1A(H)/R1A-12/OS
Potential Number of Low Density
Residential Units: 2

25 Vacant Designated
Area: 3.49ha
OP Designation: PA6-2
Zoning: R1A(H)
Potential Number of Low Density
Residential Units: 6

3 Registered
Area: 1.21ha
OP Designation: Residential
Zoning: R1A
Potential Number of Low Density
Residential Units: 1

24 Vacant Designated
Area: 5.28ha
OP Designation: PA6-2
Zoning: R1A
Potential Number of Low Density
Residential Units: 10

9 Application Under Review
Area: 1.96ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 30

18 Vacant Designated
Area: 2.37ha
OP Designation: Residential
Zoning: R2,FD
Potential Number of Low Density
Residential Units: 32

15 Vacant Designated
Area: 2.53ha
OP Designation: Residential
Zoning: FD
Potential Number of Low Density
Residential Units: 39

19 Vacant Designated
Area: 1.31ha
OP Designation: Residential
Zoning: R2,FD
Potential Number of Low Density
Residential Units: 17

16 Vacant Designated
Area: 2.60ha
OP Designation: Residential
Zoning: FD
Potential Number of Low Density
Residential Units: 39

20 Vacant Designated
Area: 2.41ha
OP Designation: Residential
Zoning: R2, FD
Potential Number of Medium Density
Residential Units: 39

17 Vacant Designated
Area: 2.62ha
OP Designation: Residential
Zoning: FD
Potential Number of Low Density
Residential Units: 32

21 Vacant Designated
Area: 1.49ha
OP Designation: Residential
Zoning: R2
Potential Number of Medium Density
Residential Units: 15

2 Registered
Area: 0.31ha
OP Designation: Residential
Zoning: R1B
Potential Number of Low Density
Residential Units: 2

11 Draft Approved/Provisional
Area: 3.19ha
OP Designation: Residential
Zoning: R1B
Potential Number of Low Density
Residential Units: 34

23 Vacant Designated
Area: 1.53ha
OP Designation: Residential
Zoning: R2
Potential Number of Low Density
Residential Units: 24

Future Development Chart

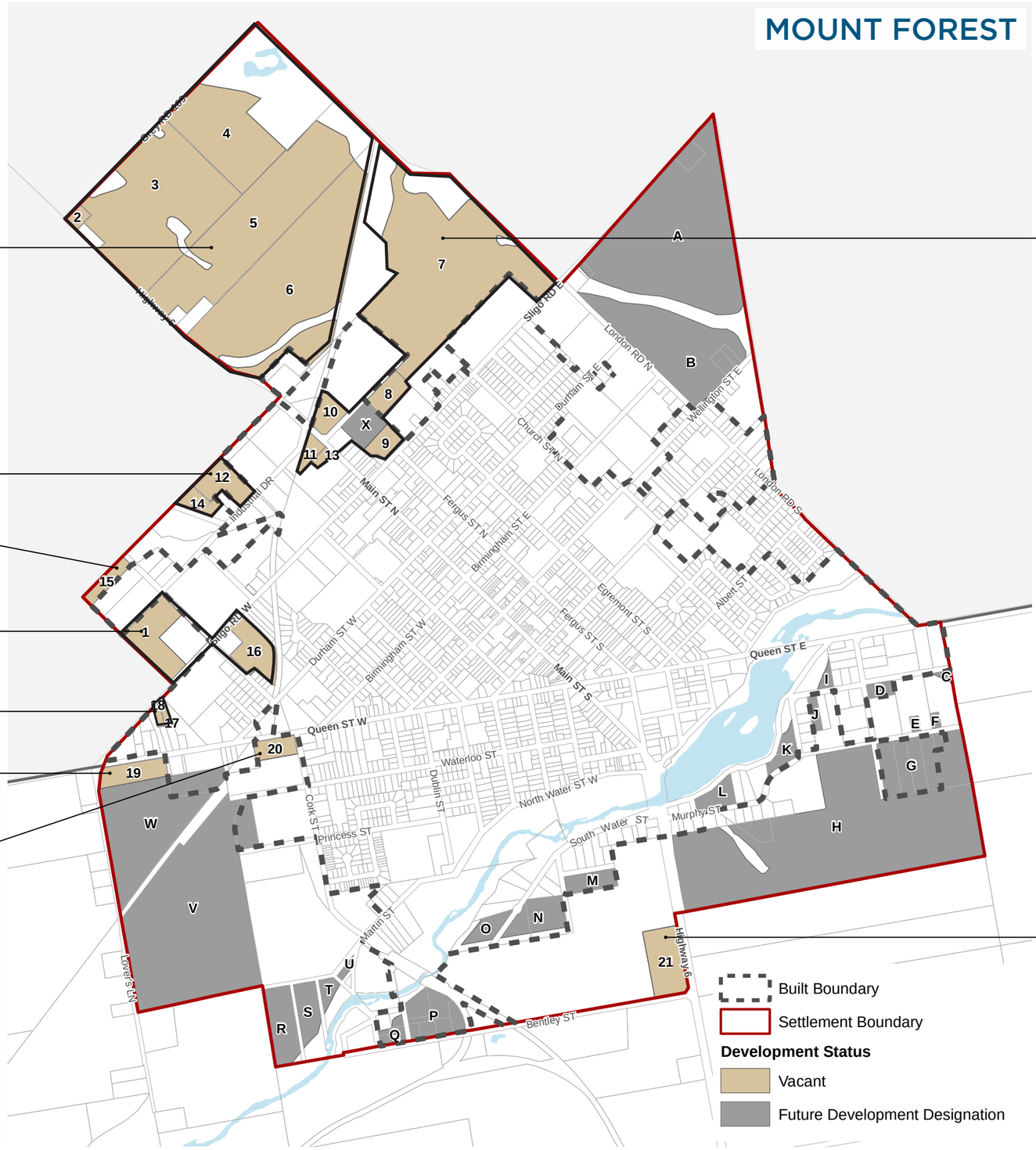
Letter	Area(Ha)	Letter	Area(Ha)
A	23.80	M	1.26
B	11.02	N	2.33
C	0.17	O	1.03
D	0.53	P	3.06
E	0.19	Q	0.72
F	0.19	R	2.81
G	4.60	S	1.65
H	37.34	T	0.56
I	0.32	U	0.19
J	0.44	V	27.20
K	0.94	W	11.84
L	1.08	X	1.58

MAP 5 - RESIDENTIAL INVENTORY - VACANT LANDS

Wellington North Community Growth Plan

GSP group

MOUNT FOREST



2
Vacant Designated
Area: 0.47ha
OP Designation: Industrial
Zoning: M1

3
Vacant Designated
Area: 19.12ha
OP Designation: Industrial
Zoning: M1-24(H), NE

4
Vacant Designated
Area: 9.75ha
OP Designation: Industrial
Zoning: M1-24(H), NE

5
Vacant Designated
Area: 18.12
OP Designation: Industrial
Zoning: M1-24(H), NE

6
Vacant Designated
Area: 23.15ha
OP Designation: Industrial
Zoning: M1-24(H), M1-23(H), NE

12
Vacant Designated
Area: 2.02ha
OP Designation: Industrial
Zoning: M1

14
Vacant Designated
Area: 0.95ha
OP Designation: Industrial
Zoning: M1

15
Vacant Designated
Area: 0.98ha
OP Designation: Industrial
Zoning: M1

1
Absorbed
Area: 3.44ha
OP Designation: Industrial
Zoning: M1

16
Vacant Designated
Area: 2.50ha
OP Designation: Industrial
Zoning: M1

17
Vacant Designated
Area: 0.27ha
OP Designation: Industrial
Zoning: R2

18
Vacant Designated
Area: 0.22ha
OP Designation: Industrial
Zoning: R2

19
Vacant Designated
Area: 1.81ha
OP Designation: Industrial
Zoning: FD

20
Vacant Designated
Area: 1.11ha
OP Designation: Highway Commercial
Zoning: M1

7
Vacant Designated
Area: 24.40ha
OP Designation: Industrial
Zoning: M1(H), M1-11, M

8
Vacant Designated
Area: 1.28ha
OP Designation: Industrial
Zoning: FD

9
Vacant Designated
Area: 1.09ha
OP Designation: Residential PA6-3
Zoning: R3-10

10
Vacant Designated
Area: 1.25ha
OP Designation: Highway Commercial
Zoning: M1-1

11
Vacant Designated
Area: 0.70ha
OP Designation: Highway Commercial
Zoning: C2

12
Vacant Designated
Area: 0.28ha
OP Designation: Highway Commercial
Zoning: C2

21
Vacant Designated
Area: 3.20ha
OP Designation: Highway Commercial
Zoning: M1-26, M1-27

Future Development Chart			
Letter	Area(Ha)	Letter	Area(Ha)
A	23.80	M	1.26
B	11.02	N	2.33
C	0.17	O	1.03
D	0.53	P	3.06
E	0.19	Q	0.72
F	0.19	R	2.81
G	4.60	S	1.65
H	37.34	T	0.56
I	0.32	U	0.19
J	0.44	V	27.20
K	0.94	W	11.84
L	1.08	X	1.58

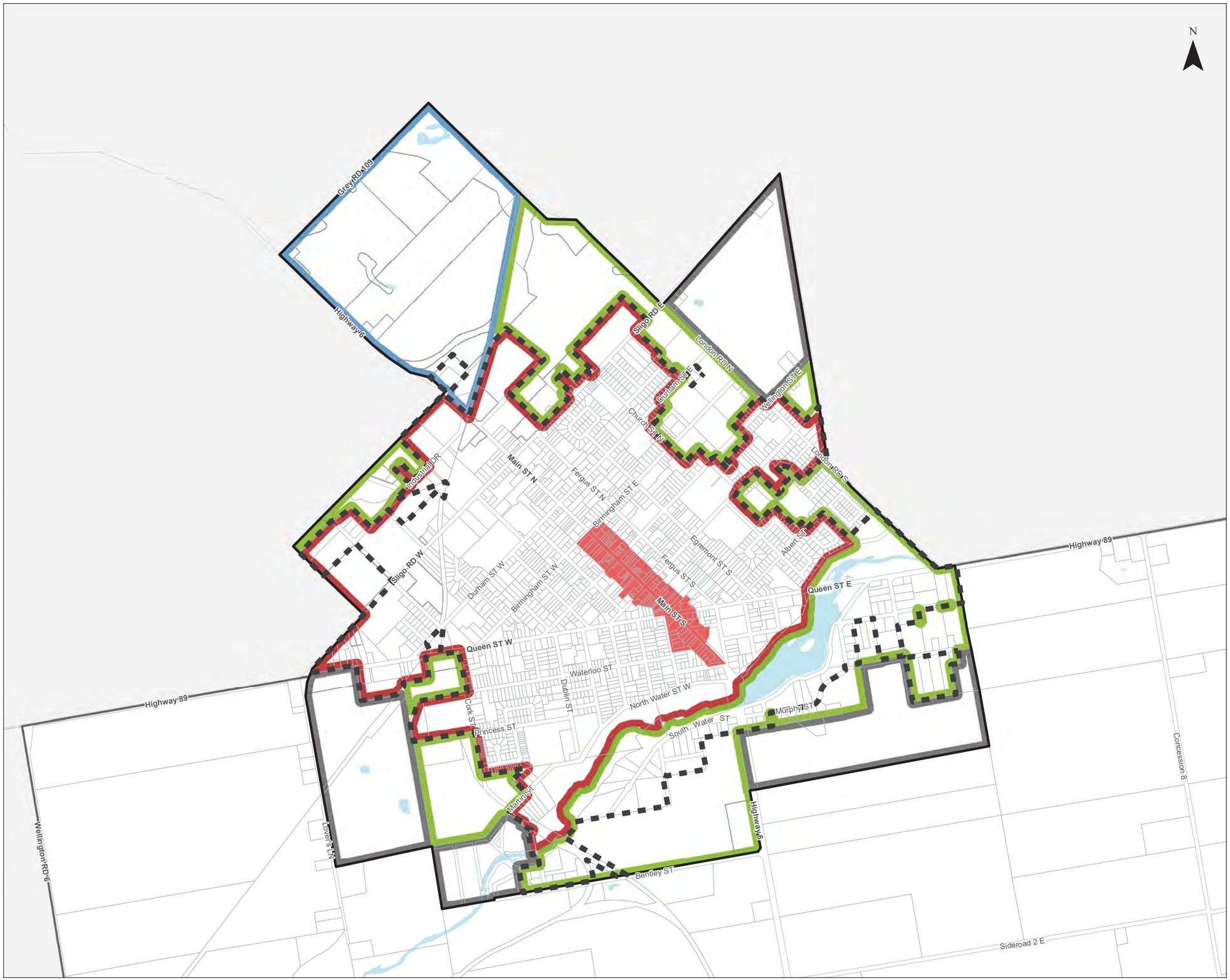
MAP 7 - NON-RESIDENTIAL INVENTORY - VACANT LANDS

Wellington North Community Growth Plan

GSP group

Devemopment Stages
Mount Forest

Wellington North
Growth Management Study



- Built Boundary
- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Urban Area Boundary
- Central Business District

0 500 1,000 Meters

Map produced using information under licence with Wellington County (2017),

GSP group

WELLINGTON NORTH
SEMPER PORRO

Staff Report

To:	Mayor and Members of Council Meeting of December 14, 2020
From:	Tammy Pringle, Development Clerk
Subject:	**DC 2020-042,** Development Updates Town of Mount Forest

RECOMMENDATION

THAT Council of the Township of Wellington North receive Report DC 2020-042 being a report on development updates in the Town of Mount Forest.

PREVIOUS PERTINENT REPORTS/BY-LAWS/RESOLUTIONS

- Wellington North Community Growth Plan, Final Report dated February 2018
- Affordable Housing in Wellington County, Presentation dated March 2019
- Triton Engineering Services Limited, Letter dated February 4, 2020 Re: 2020 Reserve Capacity Calculations Mount Forest Wastewater Treatment Plant
- Development Clerk Report DC 2020-023 Township Development updates dated September 14, 2020

BACKGROUND

On September 14, 2020 Council reviewed a report DC 2020-023, regarding development in the Township as of July 31st, 2020. This report indicated a projected increase of 764 homes, in the Town of Mount Forest. Since this report, there has been an increase in applications for draft plan of subdivision, inquiries for residential development as well as infill increases.

COMMENTS AND ANALYSIS

As of January 1st, 2020 the Town of Mount Forest had a total of 591 uncommitted sewage units available at the Waste Water Treatment Plant (WWTP). While this may seem like a considerable amount of available capacity; there are a number of developments currently working towards their construction phase that could see a steady reduction in available capacity.

It is also worth note that there is about 11.75 acres of vacant property, in the town limits, zoned Highway Commercial and approximately 37 acres of undeveloped land zoned Residential.

Planning for the future will warrant a close eye on services in order to maintain a steady course of development. Now is the time to make plans for future infrastructure. These plans should include the WWTP, but also consider wear and tear on existing services like roads, water and sewer lines, parks, trails and recreation facilities in order to keep up with the potential increase in population.

To that end, this review includes an outline of Future Development as well as Undeveloped Industrial & Commercial as well as Undeveloped Residential lands within the town limits.

FINANCIAL CONSIDERATIONS

There is no financial impact to the municipality in receiving this report. These planned developments will see a significant increase in development charges, building permit fees and increase the tax base in the township.

They will also make use of much of the Wastewater Treatment Plant capacity. Consideration to the timing of wastewater treatment plant expansion will need to be reviewed as development progresses.

ATTACHMENTS

- Appendix A – Mount Forest Residential Development Forecast as of December 1st, 2020
- Appendix B – Mount Forest Future Development, Undeveloped Industrial & Residential Lands Reference Map, as of December 1st, 2020

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:	Tammy Pringle, Development Clerk	*Tammy Pringle*
Recommended By:	Michael Givens, Chief Administrative Officer	*Michael Givens*

APPENDIX A
Mount Forest Residential Development Forecast as of December 1, 2020

Approved Residential Developments – Not Built as of December 1, 2020

DEVELOPER	LOCATION	DEVELOPMENT DETAILS	Deta-ched	Semi-Det.	Town-house	Apart. Units	Development Stage
Allan Sharpe	310 Sligo Rd W, Mount Forest	**Sligo Road Townhouses** Five - 4 Unit Cluster Townhouses			12		Building Permits Issued for 2 of 5 blocks, 16-Sept-20
Betty Dee Limited	Martin Street, Mount Forest	3 Single Detached Dwellings (Lots created by severance)	1				1 Lot Undeveloped
Brian Padfield	South of Clyde St, Mount Forest	**Maple Hill Estates** Creating 6 New Residential (R1A) Lots and 1 Retain 1 (R1A)	7				Development Agreem't Signed 8-Apr-19 # Includes B86-20
H. Bye Construction	Broomer Cres., Mount Forest	**London Road Development** Plan of Subdivision			30		Subdivision Agreement Signed 22-Jun-20
Mount Forest Developments Inc.	S of Durham, E of Main, Mount Forest	**Mount Forest Developments** Plan of Subdivision		30			Subdivision Agreement Signed 07-Oct-19
Peter & Mary Reeves	Wellington St. E., Mount Forest	Severance to create 4 Lots plus Retained Portion	1				1 Lot Undeveloped
Reeves Construction Ltd.	Ruby's Cres., Mount Forest	**Albert Street Estates** Plan of Subdivision	1				1 Lot Undeveloped
Reeves Construction Ltd.	Ronnie's Way, Dougs Cres., Mount Forest	**Lucas Subdivision** Plan of Subdivision	17	2			18 Lots Undeveloped
Sharon Farms & Enterprises Limited	730 Princess St., Mount Forest	Cluster Townhouses			15		Holding Zone Removed 12-Aug-19
South Saugeen Developments	Cork St. Mount Forest	Six Semi-Detached Dwellings		6			3 Lots Undeveloped
Shawn Aitken	400 King St. E., Mount Forest	**Marlanna Homes Inc.** Plan of Subdivision		24			5th Submission Rec'd 22-Apr-19
TOTAL APPROVED RESIDENTIAL DEVELOPMENTS – MOUNT FOREST			**27**	**62**	**57**	**0**	**146**

Tentative Residential Developments as of December 1, 2020

DEVELOPER	LOCATION	DEVELOPMENT DETAILS	Deta-ched	Semi-Det.	Town-house	Apart. Units	Development Stage
2574574 Ontario Inc. (Brad Wilson)	North side of Wellington St., Mount Forest	Wellington Street Townhouses (North Side)	1		10		Application for SPA rec'd 14-Oct-20. Zoning approved.
2574574 Ontario Inc	London Rd. N, Mount Forest	**Jack's Way** Plan of Subdivision	11	6	10	33	Notice of Decision Draft Plan Sub. Rec'd 19-Sept-19. 1st Sub for SPA sent 02-Oct-20
2574574 Ontario Inc	391 Main St. N., Mount Forest	33 Unit Apartment Building				33	4th Submission Rec'd for Site Plan 8-Oct-2020
2574574 Ontario Inc. (Brad Wilson)	South side of Wellington St., Mount Forest	Wellington Street Townhouses (South Side)	5		8		Severance Application B79/20, B80/20, B81/20
350 Cork Inc.	350 Cork St., Mount Forest	Cluster Townhouse			6		Site Plan App. Rec'd 11-Jun-2020
Avila Investments Ltd.	Bentley St & Hwy 6, Mount Forest	**AVILA (Murphy)** Plan of Subdivision	231	60	120		Submission for Subdivision Agreement Rec'd 13-Mar-20
Circuit Holdings	331 Arthur St., Mount Forest	Two – 5 Unit Street Townhouse Development			10		3rd Submission Rec'd for Site Plan 25-Nov-20
Cordon Canada Ltd.	250 Main St. S., Mount Forest	Commercial with 4 Apartments				**4**	Incomplete Site Plan Application Rec'd 07-May-2020
Ilia Routkevitch	187 King St. E., Mount Forest	**King's Court Apartments –** Two - 5 Unit Apartment Buildings Plus One –Tri-Plex Proposed Amendment				13	Site Plan Application Registered 20-Nov-20
John Welton Custom Homebuilding	NW Corner of Cork & Martin St., Mount Forest	**Sunvale Homes Inc.**	58	30	51		Draft Plan of Subdivision & ZBA 11/20 rec'd 21-Oct-20.
TOTAL APPROVED RESIDENTIAL DEVELOPMENTS – MOUNT FOREST			**306**	**96**	**215**	**83**	**700**

2020 Infill Lots Built as of December 1st, 2020

CIVIC ADDRESS	PERMIT NUMBER	ISSUED DATE	WORK PROPOSED	NUMBER OF UNITS
310 John St	2020-0037	01-Apr-20	Single Detached	1
239-249 Main St N	2020-0068	20-May-20	Residential Addition (Creation of 6th Unit)	1 Apt
776 Waterloo St	2020-0102	26-Jun-20	Single Detached	1

TOTAL RESIDENTIAL INFILL – MOUNT FOREST	3

Approved Residential Developments – Built as of December 1, 2020

DEVELOPER	LOCATION	DEVELOPMENT DETAILS	Deta-ched	Semi-Det.	Town-house	Apart. Units	Development Stage
Allan Sharpe	310 Sligo Rd W, Mount Forest	**Sligo Road Townhouses** Five - 4 Unit Cluster Townhouses			8		Building Permits Issued for 2 of 5 blocks, 16-Sept-20
Betty Dee Limited	Martin Street, Mount Forest	3 Single Detached Dwellings (Lots created by severance)	1				1 Lot Undeveloped
Reeves Construction Ltd.	Ronnie's Way, Dougs Cres., Mount Forest	**Lucas Subdivision** Plan of Subdivision	4	2			18 Lots Undeveloped
South Saugeen Developments	Cork St. Mount Forest	Six Semi-Detached Dwellings		2			3 Lots Undeveloped

TOTAL APPROVED RESIDENTIAL DEVELOPMENTS – MOUNT FOREST	5	4	8	0	17

Total Residential Developments (New & Tentative) and Single Lot Infill

	Deta-ched	Semi-Det.	Town-house	Apart. Units	TOTAL UNITS
TOTAL RESIDENTIAL – MOUNT FOREST	**340**	**162**	**280**	**84**	**866**

Available Sewage Units Available

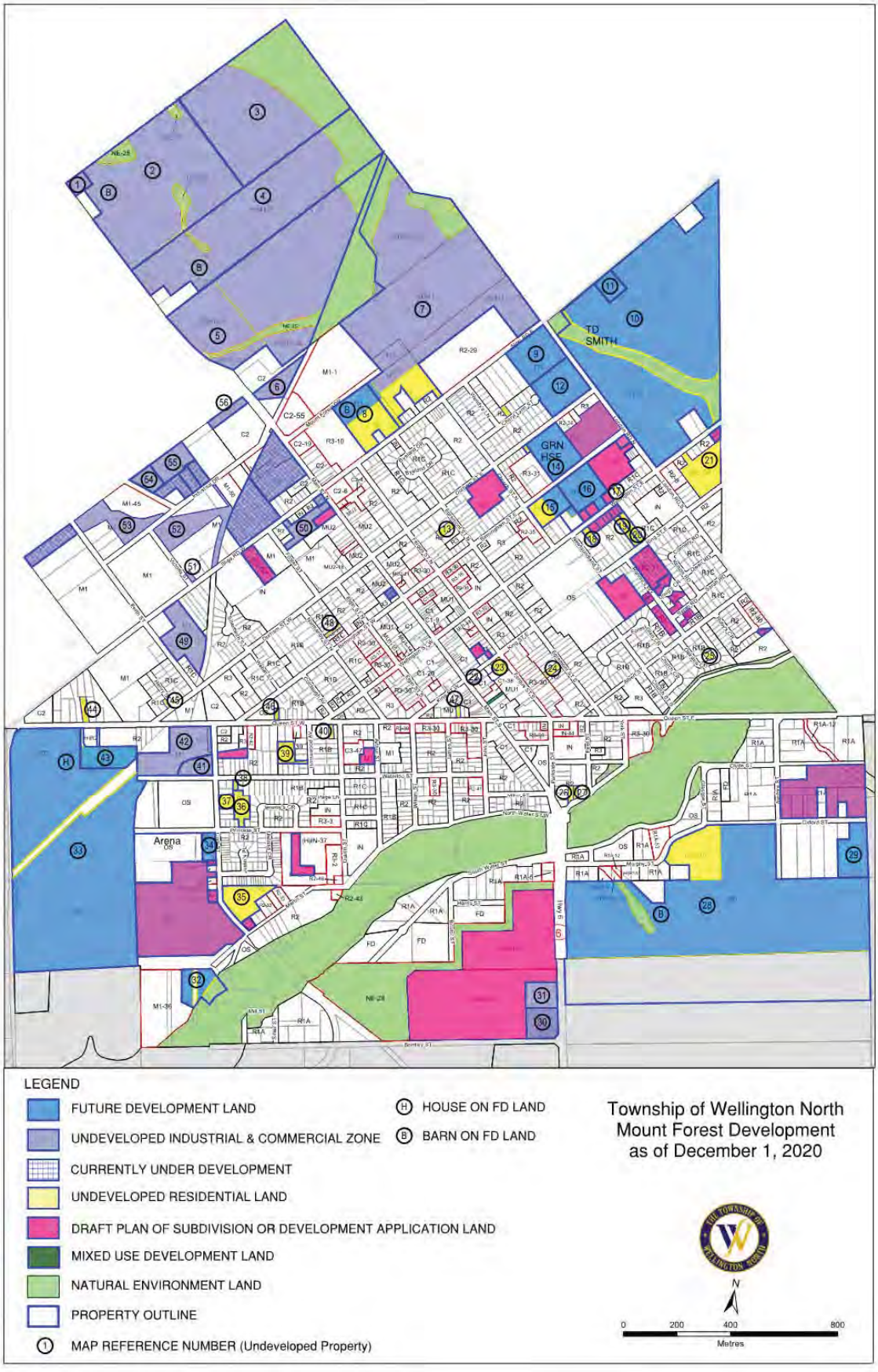
Development Comparisons	MOUNT FOREST
January 1, 2020 Balance	**591**
TOTAL SEWAGE UNITS	**591**
Less Approved Residential Development - Not Built as of December 1, 2020 (less Maple Hill Estates R1A)	139
Tentative Residential Developments as of December 1, 2020	700
Less 2020 Infill Lots (w/ Sewer Connection) Built as of December 1, 2020	3
Less Approved Residential Developments – Built as of December 1, 2020	17
Available Sewage Units	**(268)**

Undeveloped Property (approx. acreage) **(Reference Appendix B)**

MAP REF.	ROLL	ADDRESS	ZONE (RES)	ACRE (RES)	ZONE (FD)	ACRE (FD)	ZONE (IND) & (COM)	ACRE (IND)	TOTAL ACRES UN-DEVELOPED	TOTAL ACRES
1	001-18100	311145 Highway 6			FD	1.1			1.1	1.1
2	001-19000	391009 Grey Rd 109					M1	46.66	46.66	50.2
3	001-20000	391055 Grey Rd 109					M1	31.67	31.67	49.75
4	001-17200	311099 Highway 6					M1	42.86	42.86	47.1
5	001-16000	311075 Highway 6					M1	55.63	55.63	86.97
6	001-14000	620 Main St. N.					C2	2.15	2.15	2.15
7	001-13900	Sligo Road E. (MPAC shows different property line)	R3 & R2	4.88	FD	0.16	M1	63.5	68.54	52.5
8	001-06200	Sligo Road E.	R2	4.54	FD	3.07			7.61	7.61
9	001-07500	Sligo Road E.			FD	6.29			6.29	6.29
10	001-06005	530 - 540 Sligp Road E.			FD	80.16			80.16	88.94
11	001-05900	550 Sligo Road E.			FD	0.48			0.48	0.48
12	001-03100	Durham St. E.			FD	6.25			6.25	6.25
13	001-07600	265 Egremont St. S.	R2	0.50					0.50	0.50
14	001-02700	460 Durham St. E. (Mount Forest Green Houses)			FD	5.82			5.82	5.82
15	002-02400	Church St.	R2	1.46	FD	1.84			3.30	3.30
16	002-02310	447 – 469 Wellington St. E.	R2	0.02	FD	5.66			5.68	5.68
17	002-02312	Wellington St. E.	R1C	0.17					0.17	0.17
18	002-01805	Wellington St. E.	R2	0.50					0.50	0.50
19	002-00125	425 King St. E.	R2	0.77					0.77	0.77
20	002-00123	427 King St. E.	R2	0.77					0.77	0.77
21	003-20300	Wellington St. E.	R2-58	4.98					4.98	4.98
22	003-13000	210 Main St. S.					C1	0.13	0.13	0.13
23	003-06500	190 King St. E.	R3-7/MU	0.86					0.86	0.86
24	003-09700	243 Egremont St. S.	R2	0.44					0.44	0.44
25	003-07526	Oakview Cres.	R1C	0.24					0.24	0.24
26	003-18050	Water St. E.	R2	0.31					0.31	0.31
27	003-18060	Water St. E.	R2	0.23					0.23	0.23
28	003-00100	180 Murphy St.	R1A	6.67	FD	85.13			91.8	139.98
29	003-00810	Oxford St.			FD	4.32			4.32	4.32
30	006-07600	Commercial Lot Created w/ Avila Development					C2	4.50	4.50	4.50
31	006-07600	Commercial Lot Created w/ Avila Development					C2	3.62	3.62	3.62
32	004-00100	Martin St.			FD	2.83			2.83	3.84
33	004-03900	660 Queen St. W			FD	74.71			74.71	74.71
34	004-00150	Princess St.			FD	1.01			1.01	1.01
35	006-06520	Martin St.	R2	4.00					4.00	4.00
36	006-03301	Princess St.	R2	1.61					1.61	1.61
37	006-11170	Cork St.	R2	0.89					0.89	0.89
38	006-03305	Waterloo St.	R2	0.14					0.14	0.14
39	005-18850	355 Homewood Ave.	R1B	1.51					1.51	1.51
40	005-03800	Queen St. W.	R1B	0.25					0.25	0.25
41	004-04503	Cork St.					M1	1.93	1.93	1.93
42	004-04501	590 Queen St. W.					C2 & M1	8.78	8.78	8.78
43	004-04000	650 Queen St. W.			FD	0.84			0.84	0.84
44	004-03420	657 Queen St. W.	R2	0.51					0.51	0.51
45	004-09790	Durham St. W.	R1C	0.13					0.13	0.13
46	004-02610	485 Queen St. W.	R1B	0.18					0.18	0.18
47	005-05800	141 Queen St. W.	MU1	0.20					0.20	0.20
48	004-20104	Normanby St. N.	R2-51	0.25					0.25	0.25
49	004-23202	Perth St.					M1	5.36	5.36	5.36
50	004-19000	Foster St.					M1	2.47	2.47	2.47
51	004-11905	Sligo Rd. W.					M1	0.19	0.19	0.19
52	004-11950	Industrial Dr.					M1	6.78	6.78	6.78
53	004-16260	Industrial Dr.					M1	4.19	4.19	4.19
54	004-16200	245 Industrial Dr.					M1	2.75	2.75	2.75
55	004-16216	Industrial Dr.					M1	3.18	3.18	3.18
56	004-16210	535 Main St. N.					C2	1.20	1.20	1.20
		TOTAL UNDEVELOPED ACRES	**RES**	**37.01**	**FD**	**379.67**	IND/COM	**287.55**	**604.23**	**703.36**

APPENDIX B

Mount Forest Future Development, Undeveloped Industrial & Residential Lands Reference Map
as of December 1st, 2020



APPENDIX B
WELL PUMP INFORMATION

INTERNATIONAL WATER SUPPLY LTD.

Ground Water Development - Drilling Services
Pumps - Water Treatment - Service & Maintenance
BARRIE BELOEIL, PQ SASKATOON
342 Bayview Dr., P.O. Box 310
Barrie, Ontario, Canada, L4M 4T5
Tel.705-733-0111 • 800-461-9636 • Fax 705-721-0138
E-mail: iws@barint.on.ca

FAXED

DATE: February 18, 2000

TO: John Schmidt
Wellington North HEC

FAX # 1-519-323-2425

FROM: J.C. Brownell

REFERENCE: MOUNT FOREST

Nº OF PAGES INCLUDING COVER: 6

MESSAGE:

John

Further to B.M. Ross' fax, which you re faxed February 9/00, we have checked our old files and forward the following information.

Well No. 3

- Drilled and tested - 1955
- 2 1/2 day test with Q varying 300 - 425 IGM
- Procedures at that time more or less a demonstration of capacity - no "aquifer analysis".
- ** Test data not suitable for analysis.
- Well performance check 1993 - only modest decline since 1955 - no rehabilitation.

Well No. 4

- Drilled and tested - 1963
- Controlled 24 hour Aquifer Test @ 300 IGM.
- Monitoring in OW @ 1400 ft. radius
  Well No. 2 @ 2450 ft. radius
  Well No. 3 @ 3300 ft. radius
- Most recent well performance check in 2000.
  This showed significant performance decline.

Well No. 5

- Silgo Road - Drilled and tested - 1968
- Controlled 24 hour Aquifer Test @ 400 IGM
- Monitoring in OW @ 13 ft. radius
  No. 3

- Most recent well performance check in 1997, which showed satisfactory results.

Well No. 6

- Perth Street - Drilled and tested - 1979
- Controlled 24 hour Aquifer Test @ 600 IGM
- Monitoring in Well No. 4 @ 1600 ft. radius
  Well No. 2 @ 3300 ft. radius
- Most recent well performance check in 1995, which showed satisfactory performance.

Best Regards,

J.C. Brownell, P. Eng.

P.S. Attached are copies of Well Drawings.

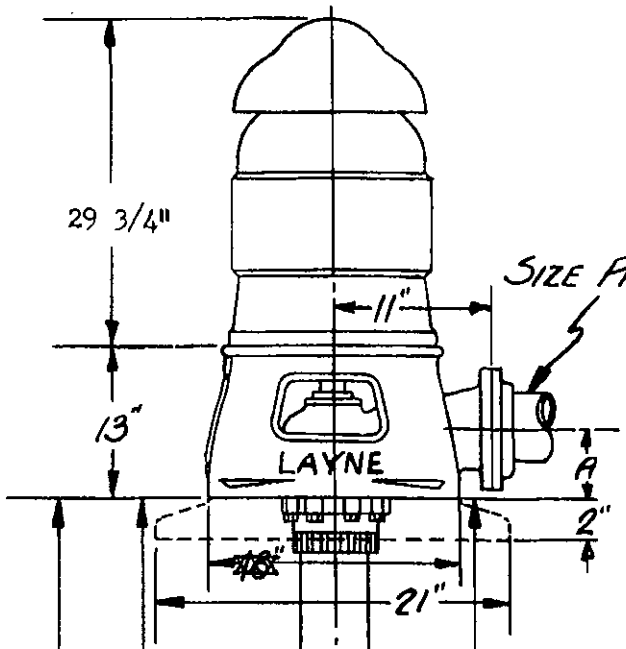
INSTALLATION PLAN
TF PUMP HEAD

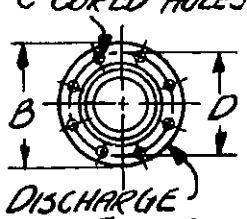
LAYNE & BOWLER INC.
MEMPHIS, TENN.

1/10

S/N 33837
Well 3

HEAD PATT. No.	A	B	C	D	R	S
TF6/3	6"	11"	8-7/8"	9½"	11"	9½"





USE THESE DIMENSIONS ONLY WHEN CERTIFIED BY FACTORY.

ALL NEW BELOW THIS NOTED NOV. 93

ONE PIECE
10' 0" LONG

150' 0"

13 PIECES
10' 0" LONG

7 5/8"

155' 6"

ONE PIECE
10' 0" LONG

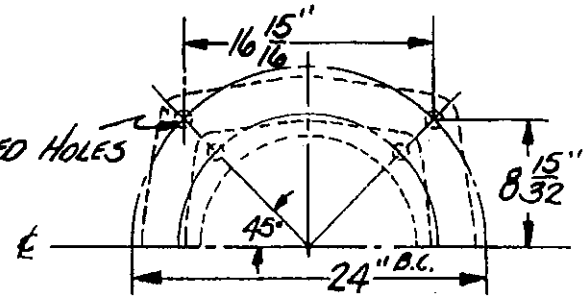
7 7/8"

5' 6"

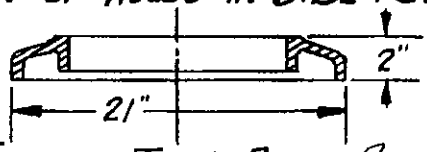
TYPE 10" RKLC BOWLS

6 STAGES

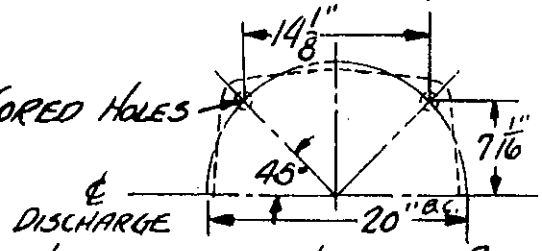
10 FT. OF 6 IN. SUCTION



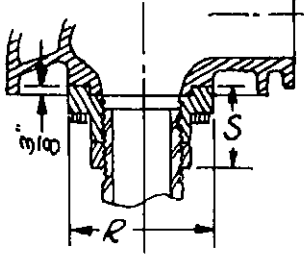
LOCATION OF HOLES IN BASE PLATE



SECTION THRU. BASE PLATE



LOCATION OF HOLES IN BASE OF ELL



SECTION THRU. BASE OF ELL

2975

PRINTED IN U.S.A.

IWS WELL & MAINTENANCE REPORT

2/10

CONTRACT	JOB NO.	WELL NO.	PUMP NO.
MT FOREST		3	33837
SERVICE TECHNICIAN		DATE	
W DUNN		NOV 11/93	
LOCAL ADDRESS		PHONE	

PUMP DESCRIPTION

NO. 33837 HEAD SHAFT MAT'L. SS DIAM. PIPE 6" [~~Steel~~ Cpld. SETTING BP to MB 150'
BOWL SIZE 10" OUTLET DIAM. 6" DIAM. TUBING — LGTH. BOWL 5'1
TYPE RICLC IMP. MAT'L. BR DIAM. SHAFT 1" LGTH. SUCTION 10'
NO. STAGES 6 BOWL MAT'L. CI LINE SHAFT MAT'L. SS STRAINER —
HEAD TF613 MAX. COL. SECTION 10' DIAM. SUCTION 6" LGTH. AIR LINE 150 Mat'l.
SPECIALS: ZINC SLEEVES [ ]yes [~~x~~]no NO. TAPED OIL LINE [ ]yes [ ]no
OTHER GAUGES: ALT: 0 - ft. PRESS. 0 - psi.

MOTOR DESCRIPTION

MAKE US R.P.M. 1800 PHASE 3 SERIAL NO. 2494476
TYPE CFU FRAME 365 CYCLES 60 UPPER BRG. 7220M
H.P. 30 AMPS. 74/37 VOLTS 230/460 LOWER BRG. 6212

STANDBY DRIVE — SPECIAL EQUIPMENT

MAKE GEAR MODEL MAKE ENGINE NO. CYLS.
RATIO FLEX. SHAFT MODEL GOV'D R.P.M.
SERIAL FLGS. SERIAL FUEL

WELL DESCRIPTION

DEPTH FROM BASE PLATE 340'8"
INSIDE DIAM. 12
STATIC LEVEL 24.8m = 81.3'

SUBMERSIBLE PUMP ONLY — INFORMATION

MAKE OF STARTER SIZE
QUICK TRIP OVERLOAD RELAY NO.:
3 PHASE PROTECTION YES [ ] NO [ ]
MOTOR WARRANTY CARD COMPLETED [ ]yes [ ]no GIVEN TO

PERFORMANCE CHECK

SHUT OFF HEAD: A.G.H. psi. W.L.

TIME Date	PUMPING RATE Meter [ ] Orifice [✓]	PUMP PRESS. psi.	WATER LEVEL Air Line Tape	R.P.M.	VOLTS	AMPS.
					66.4	
						64.3
	280 = 336 USgpm		39.35 m			72.3
			129'07			62.1

NOW WATER LUBRICATED!
ALL NEW BELOW HEAD + STUFFING BOX
NEW AIR LINE 150
+ MISC FITTINGS

SN 33837

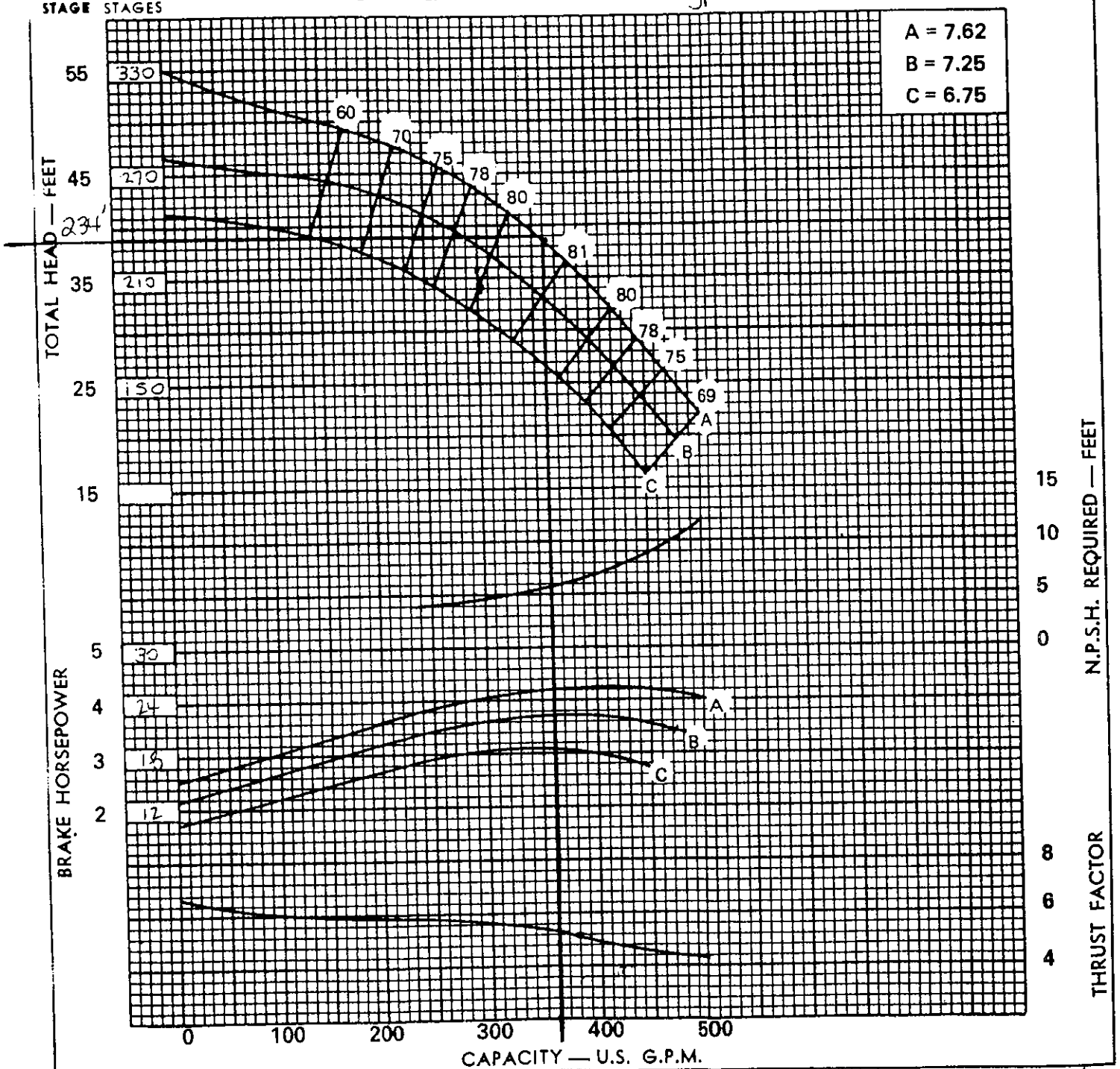
CURVE NO	No. Stages	Eff. Change	MATERIAL	Eff. Change
18-061	1	−3	IMP.—C.I.	−2
6-1-77	2	−2	IMP.—NI-RI	−1
	3	−1	BOWL—BRZ.	−1
	4	0	BOWL—NI-R.	−1

10 RKLC **1760** R.P.M.

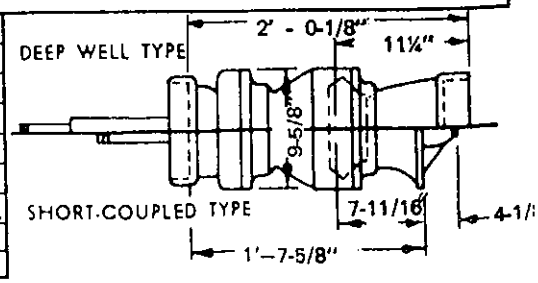
SINGLE STAGE LAB PERFORMANCE WITH STANDARD MATERIALS. EFFICIENCY SHOWN FOR 4 OR MORE STAGES. HORSE POWER SHOWN FOR ONE STAGE BASED ON 4 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.

ONE STAGE (6) STAGES

Well No. 3 360 USgpm @ 234'



EYE AREA — SQ. IN.	=	10.15		IMPELLER WT.-LBS.	= 10.1
WR² PER IMPELLER	=	0.44 LB.-FT²		ONE STAGE WT.-LBS.	= 185
MAX. SPHERE SIZE	=	0.47 in.		ADD'L STAGE WT.-LBS.	= 67
MAX. NO. STD. STAGES	=	29		IMPELLER NUMBER	= 5RK13
MAX. OPERATING P.S.I.	=	700		DISCH. SIZES	= 5,6,7,8
STD. LATERAL	=	0.92 in.		SUCTION SIZES	= 6
STD. SHAFT DIA.	=	1.500 in.		MAX. LATERAL	= -------- in.
MAX. SHAFT DIA.	=	1.687 in.		BOWL CONN.	THREADED-COLLET
MIN. SUBMERGENCE	=	13 in.		ADD 7-7/16	" PER ADDITIONAL STAGE.



INSTALLATION PLAN

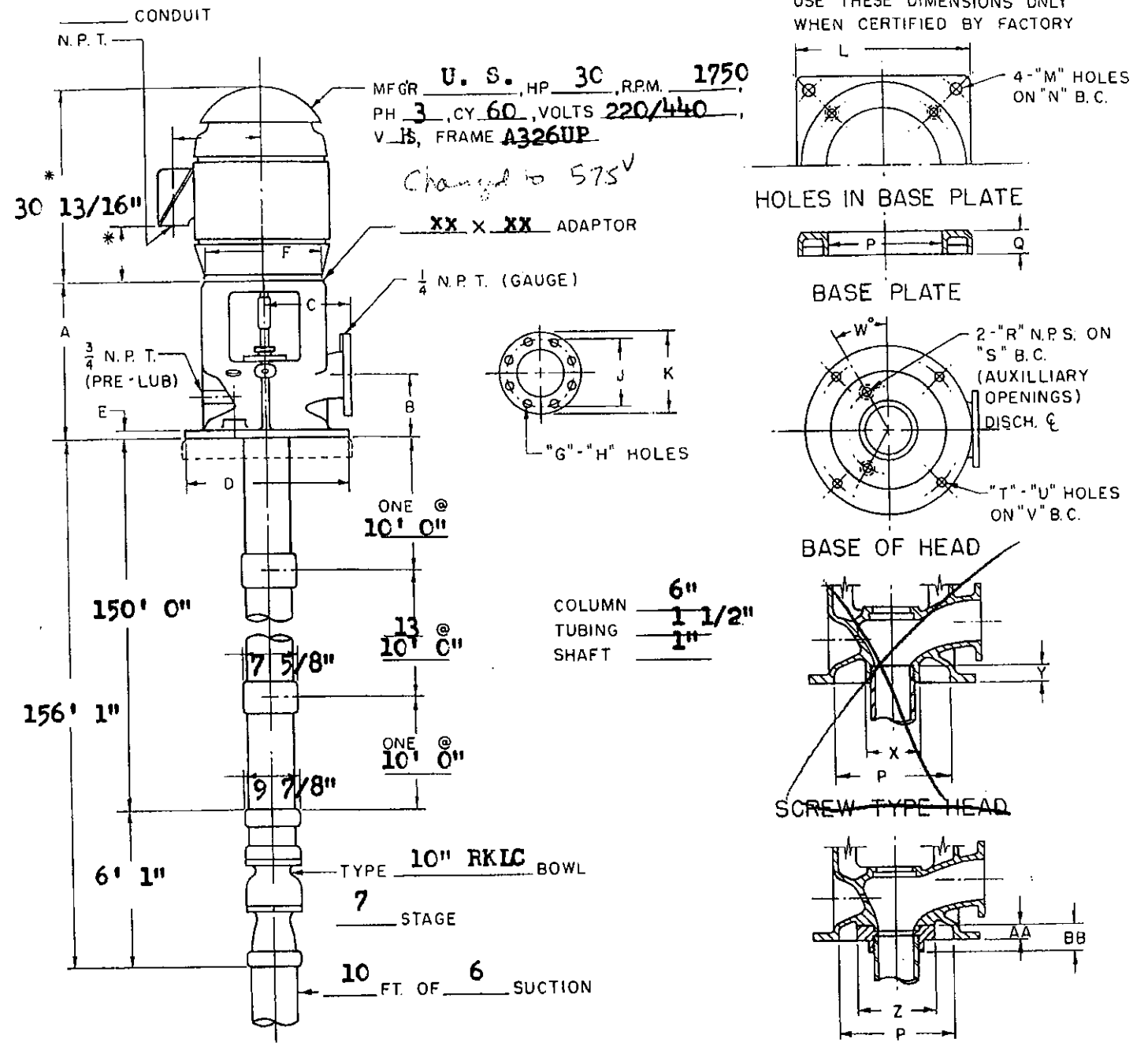
TYPE 6 SDH DISCHARGE HEAD

LAYNE & BOWLER, INC. MEMPHIS, TENNESSEE

3/10

WELL NO 4

USE THESE DIMENSIONS ONLY
WHEN CERTIFIED BY FACTORY



CUSTOMER: Public Utilities Comm.	YOUR NO: 630789	G. P. M. 360
LOCATION: Mount Forest, Ontario, Canada Well 4	OUR NO: 63D-3718	T. D. H. 273
FOR APPROVAL: Tom Morrow	PUMP NO: 47651	R. P. M. 1750
CERTIFIED:	DATE: 9-10-63	B. H. P.

TYPE HEAD	A	B	C	D	E	F	HEAD DISCHARGE FLANGE 125# ASA FLANGE G	H	J	K	250# ASA FLANGE G	H	J	K	L	M	N	P	Q	R	S	HEAD BASE STD. T	U	125# T	U	V	W	X	Y	Z	AA	BB
SDH 3	14	5 1/4	7 1/2	13 1/2	3/4	10	4	3/4	6	7 1/2	8	7/8	6 5/8	8 1/4	13 3/4	3/4	15 3/4	9 1/4	1 1/2	1/2	7 3/8	4	3/4	8	7/8	11 1/4	24	4 1/8	1 1/4	5 1/2	1 1/4	3 1/4
SDH 4	16 1/2	6	9	16	3/4	12	8	3/4	7 1/2	9	8	7/8	7 7/8	10	16 1/4	3/4	18 1/4	11 1/4	1 1/2	1/2	8 1/2	4	3/4	12	1	14 1/4	18 1/2	5 1/2	1 13/16	7	1 5/8	3 3/4
SDH 6	20	7	11 1/2	21	3/4	16 1/2	8	7/8	9 1/2	11	12	7/8	10 3/8	12 1/2	21 1/4	1	24 1/4	14 1/2	1 1/2	3/4	11 1/2	4	3/4	12	1 1/8	18 3/4	20	7 3/4	2 1/16	9 3/8	1 5/8	4 1/4
SDH 8	22	8 1/2	13	23 1/2	7/8	16 1/2	8	7/8	11 3/4	13 1/2	12	1	13	15	23 3/4	1	27 1/4	16 1/2	2	1	14	4	7/8	16	1 1/8	21 1/4	20	10	2 5/16	11 1/2	1 5/8	4 1/4
SDH 10	25	11	15	27 1/2	1	20	12	1	14 1/4	16	16	1 1/8	15 1/4	17 1/2	27 3/4	1 1/8	31 1/2	20 1/2	2	1	17	4	7/8	20	1 1/4	25	24	12 1/4	2 15/16	14 1/2	2 1/4	5 1/4
SDH 12	26	11 1/2	17	32	1 1/8	24 1/2	12	1	17	19	16	1 1/4	17 3/4	20 1/2	32 1/4	1 1/8	37	24 1/2	2	1	19 1/4	4	7/8	20	1 3/8	29 1/2	17	14	2 15/16	16 1/2	2 1/8	5 1/4

* INCLUDES 3" HIGH MOTOR ADAPTOR WHEN USED

DRAWING NO. PBO 119

IWS WELL & MAINTENANCE REPORT

4/10

CONTRACT: M.T. FOREST OIL	JOB NO.	WELL NO. 4	PUMP NO. 47651
SERVICE TECHNICIAN: J HARTMAN		DATE: July 13/95	
LOCAL ADDRESS		PHONE	

PUMP DESCRIPTION

NO. 47651 — HEAD SHAFT MAT'L. CRS — DIAM. PIPE 6" [Flgd. / Cpld.] — SETTING BP to MB 150'

BOWL SIZE 10" — OUTLET DIAM. 6" — DIAM. TUBING 1½" — LGTH. BOWL 6'1"

TYPE RKLC — IMP. MAT'L. BRONZE — DIAM. SHAFT 1" — LGTH. SUCTION 10

NO. STAGES 7 — BOWL MAT'L CAST IRON — LINE SHAFT MAT'L. CRS — STRAINER —

HEAD 6SDH 16 — MAX. COL. SECTION 10' — DIAM. SUCTION 6" — LGTH. AIR LINE 152 Mat'l.

SPECIALS: ZINC SLEEVES [ ]yes [✓]no NO. .... TAPED OIL LINE [✓]yes [ ]no JOINTS ONLY

OTHER .... GAUGES: ALT: 0 - .... ft. PRESS. 0 - .... psi.

MOTOR DESCRIPTION

MAKE USEM — R.P.M. 1800 — PHASE 3 — SERIAL NO. 3520758

TYPE RU — FRAME A-326UP — CYCLES 60 — UPPER BRG. 7218 BGC

H.P. 30 — AMPS 76/38 — VOLTS 220/440 AVE — LOWER BRG. 6210

VOLTS A-B 230 · LOWS 243
B-C 240 · 244
A-C 230 · 239

STANDBY DRIVE — SPECIAL EQUIPMENT

MAKE GEAR .... MODEL .... MAKE ENGINE .... NO. CYLS. ....

RATIO .... FLEX SHAFT .... MODEL .... GOV'D R.P.M. ....

DIAL .... FLGS. .... SERIAL .... FUEL ?

VOLTS TO GROUND A = 166 B = 188 C = 77
NOT THE BEST.

WELL DESCRIPTION

DEPTH FROM BASE PLATE ....

INSIDE DIAM. 12"

STATIC LEVEL 62' 4¾"

SUBMERSIBLE PUMP ONLY — INFORMATION

MAKE OF STARTER .... SIZE ....

QUICK TRIP OVERLOAD RELAY NO.: ....

3 PHASE PROTECTION YES [ ] NO [ ]

MOTOR WARRANTY CARD COMPLETED [ ]yes [ ]no GIVEN TO ....

PERFORMANCE CHECK SHUT OFF HEAD: .... A.G.H. psi. .... W.L. ....

TIME Date	PUMPING RATE Meter [ ] Orifice [✓]	PUMP PRESS. psi.	WATER LEVEL Air Line Tape	R.P.M.	VOLTS	AMPS.
	300 30½ 2 on 4½	48 = 111	129' 5⅜"			78
						82 8
		TDH = 248				79.2
Cut Off	250	60 psi	116'	75/76/78 amps		

Pulled - Cleaned up oil. Check shafting, column ends dressed
All bowl parts & shaft installed.
Main bearing OK - Turned deeper for seals. Shaft stood down 13 (4t)
Change 4 motor bearings. No bottom. Same as bottoms for well no.
9 how! Changed shaft oil to Petro Can Purity FGW 035

SN 47651

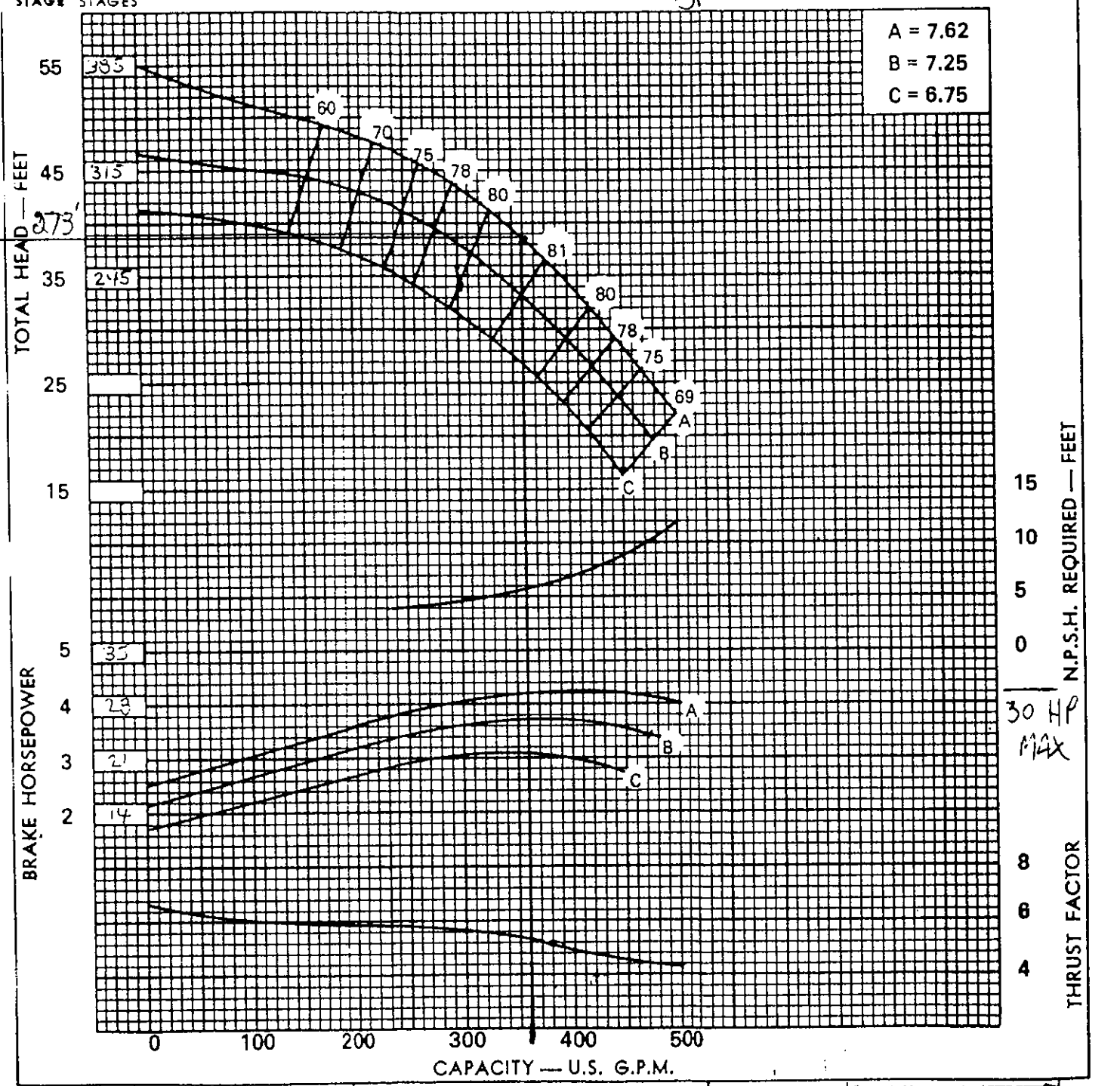
CURVE NO	No. Stages	Eff. Change	MATERIAL	Eff. Change
18-061	1	−3	IMP.—C.I.	−2
6-1-77	2	−2	IMP.—NI-RI	−1
	3	−1	BOWL—BRZ.	−1
	4	0	BOWL—NI-R.	−1

10 RKLC **1760** R.P.M.

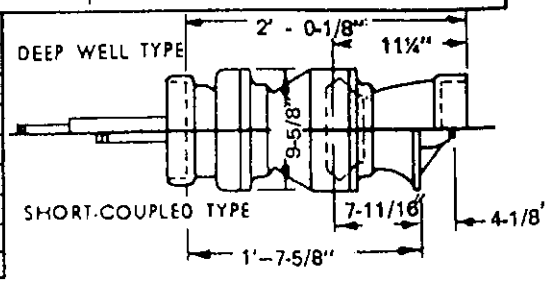
SINGLE STAGE LAB PERFORMANCE WITH STANDARD MATERIALS. EFFICIENCY SHOWN FOR 4 OR MORE STAGES. HORSE POWER SHOWN FOR ONE STAGE BASED ON 4 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.

ONE STAGE (7) STAGES

WELL No. 4 360 USgpm @ 273'



EYE AREA — SQ. IN.	=	10.15		IMPELLER WT.-LBS.	= 10.1
WR^2 PER IMPELLER	=	0.44	LB.-FT.^{2}	ONE STAGE WT.-LBS.	= 185
MAX. SPHERE SIZE	=	0.47	in.	ADD'L STAGE WT.-LBS.	= 67
MAX. NO. STD. STAGES	=	29		IMPELLER NUMBER	= 5RK13
MAX. OPERATING P.S.I.	=	700		DISCH. SIZES	= 5,6,7,8
STD. LATERAL	=	0.92	in.	SUCTION SIZES	= 6
STD. SHAFT DIA.	=	1.500	in.	MAX. LATERAL	= ——— in.
MAX. SHAFT DIA.	=	1.687	in.	BOWL CONN.	THREADED-COLLET
MIN. SUBMERGENCE	=	13	in.	ADD 7-7/16	" PER ADDITIONAL STAGE.



ernational Water Supply
ıce Wilson

Goulds Turbine Pump Selection ver: 6.042
07/24/02

PUMP DATA SHEET
Turbine 60 Hz

Selection file: (untitled)
Catalog: SUB60.MPC v 2.00

ırve: E6209CFPCO

Point: Flow: 721 US gpm
Head: 300 ft

mp: **TURBINE - 3600**
Speed: 3525 rpm

Size: 9RCLC, (2 stages)
Dia: 6.5625 in

nits: Temperature: 120 °F
Pressure: 400 psi_g

Sphere size: 0.56 in
Power: --- bhp

ıecific Speed: Ns: 2290 Nss: ---

ırtical Turbine: Bowl Size: 9.25 in Max Lateral: 0.88 in
Thrust K Factor: 4.9

ɔtor: 75 hp Speed: 3600 Frame: 8"
NEMA Standard SUB Enclosure
sized for Max Power on Design Curve

Fluid: Water
Temperature: 60 °F
SG: 1
Viscosity: 1.122 cP
Vapor pressure: 0.2568 psi_a
Atm pressure: 14.7 psi_a

NPSHa: --- ft

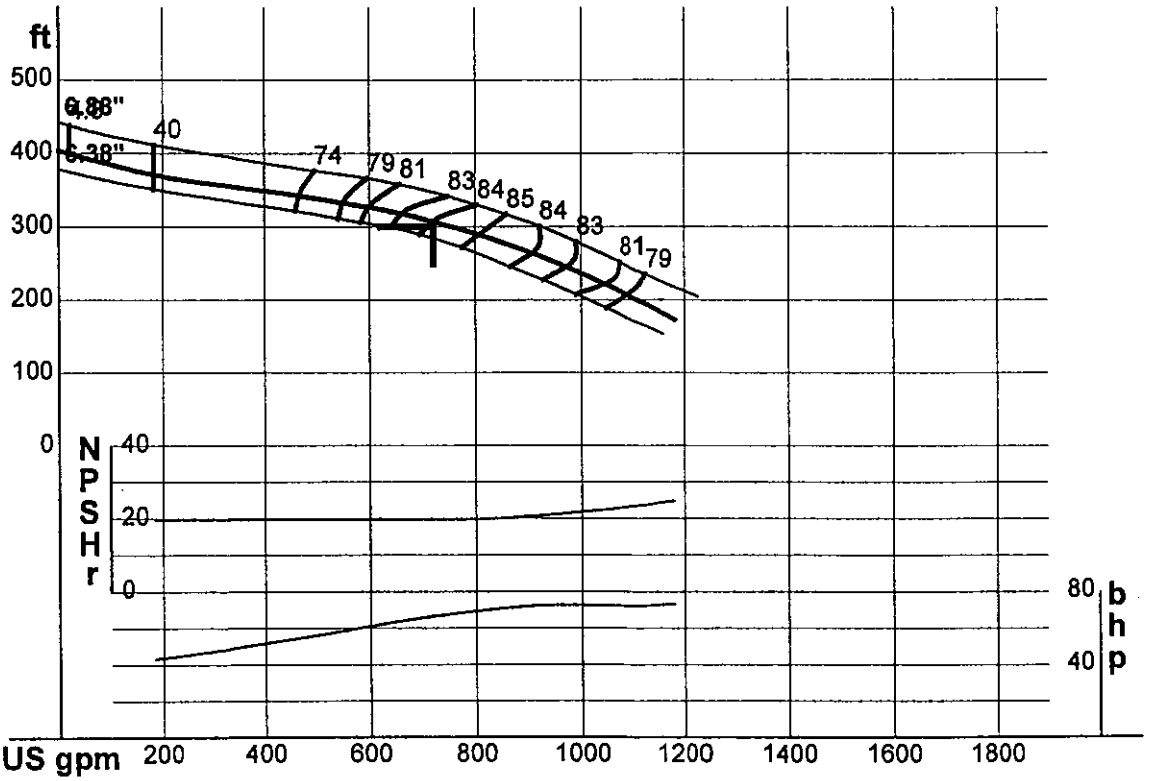
Piping:
System: ---
Suction: --- in
Discharge: --- in

Suction Size-6" Discharge Sizes-5",6",8"

---- Data Point ----
Flow: 721 US gpm
Head: 307 ft
Eff: 84%
Power: 66.5 bhp
NPSHr: 19.7 ft

Design Curve --
Shutoff Head: 404 ft
Shutoff dP: 175 psi
Min Flow: - US gpm
BEP: 85% eff
@ 808 US gpm
NOL Pwr: 73.2 bhp
@ 1183 US gpm

-- Max Curve --
Max Pwr: 84.8 bhp
@ 1230 US gpm



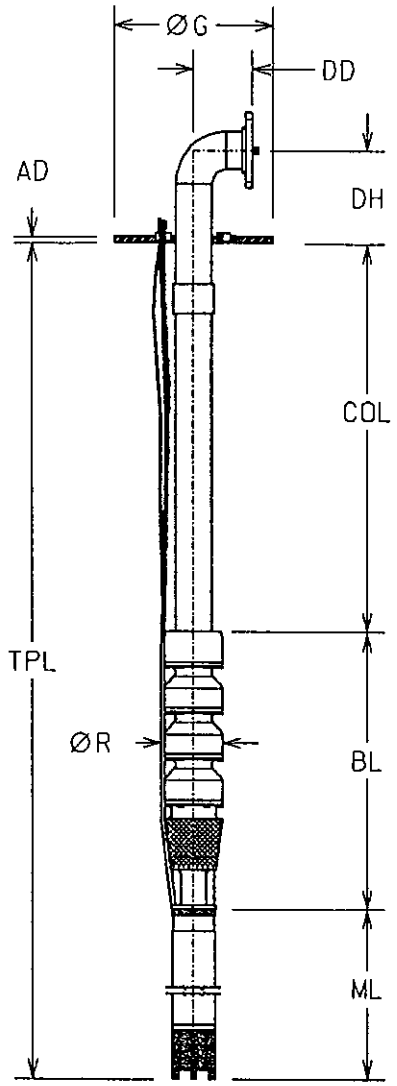
--- PERFORMANCE EVALUATION ---

Flow US gpm	Speed rpm	Head ft	Pump %eff	Power bhp	NPSHr ft	Motor %eff	Motor kW	Hrs/yr	Cost /kWh
865	3525	275	84.4	70.9	20.3				
721	3525	307	84	66.5	19.7				
577	3525	329	80.1	59.9	19.7				
433	3525	346	69.9	53.2	19.7				
288	3525	360	52.5	47.3	19.7				

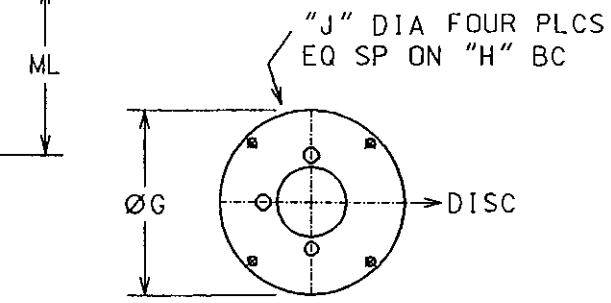
Mount Forest Well No. 5

International Water Supply
Bruce Wilson

HYDRAULIC ANALYSIS
VIS-WF
2 Stage 6x9RCLC



AD:	1.13
AG:	
BL:	36.63
CAN:	N/A
CD:	
CL:	N/A
COL:	1380.00
DD:	10.88
DH:	16.50
G:	19.00
H:	17.00
HH:	
J:	1.00
R:	9.81
ML:	49.69
SL:	
TPL:	1466.32
UG:	N/A
V:	
W:	
X:	
SD:	
Y:	
Z:	



WELL HEAD

Pump Data

Size:	9RCLC
Stages:	2
Impellers:	Bronze
Bowl:	Cast Iron
BowlShaft:	416SS 1.50"
LineShaft Matl:	N/A
LineShaft Type:	N/A
Column:	Steel
Column:	6"
Bearing Spacing:	N/A
Section Length:	
Head:	Heavy Duty
Flange (Disch.):	6" 150#
Inlet:	
Lineshaft Coupling:	N/A
Seal:	N/A
Strainer:	N/A
SubBase:	N/A

Hydraulic Data

Flow (gpm):	721
Pump Head (ft):	236.1
TDH (ft):	307.0
Speed (rpm):	3525
Fluid:	Water
Temperature (F):	60
Viscosity:	1.122
Spec.Grav:	1

Miscellaneous

Thrust At Design:	1520
Thrust At Shutoff:	1995
Min Water Level(in):	780

Weight

Pump:	258
Motor:	430
Total:	688

Motor Data

Model:	575/3/60
Make:	Franklin
HP:	75
RPM:	3600
Type:	SUB
Efficiency:	88.0
Frame:	8"

Version: 2.30P

Mount Forest Well No. 5

Date: 07-24-2002

nternational Water Supply
Bruce Wilson

HYDRAULIC ANALYSIS
VIS-WF
2 Stage 6x9RCLC

Overall Pump Parameters

Size and Model:	9RCLC	Pump Operating Speed, RPM:	3525
Capacity, GPM:	721	Total Dynamic Head, Ft.:	307.0
Total Pump Length, In.:	1466.3	Impeller Trim, In.:	6.6
Pump Type:	Submersible	Head Type:	Heavy Duty
Pump K-Factor:	4.9	Number of Stages:	2
		Pumping Level, In.:	780.0

Bowl Data

Total Bowl Length, In.:	36.63	Bowl Diameter, In.:	9.25
Bowl Shaft Dia, In.:	1.50	Bowl Shaft Limit, HP:	510
		Bowl Shaft Material:	416SS

Column Data

Column Diameter, In.:	6	Column Load, Lb.:	1032.0
Wall Thickness, In:	inch	Column Elongation, In.:	0.01

HorsePower Data

		Thrust Load Loss, Hp.:	0.00
Bowl HP At Design, Hp.:	66.5	Motor HorsePower, Hp.:	75

Head Data

Column Loss, Ft.:	5.16	Discharge Head Loss, Ft.:	0.76
		Total Loss, Ft.:	5.93

Other Data

Hydraulic Thrust, Lb.:	1504.3	Thrust at Design, Lb.:	1519.6
Thrust at Shutoff, Lb.:	1994.9	Design NPSH, Ft.:	19.7
		Actual Head above Grade, Ft.:	236.07

Efficiency Data (Efficiencies estimated not guaranteed)

Bowl Efficiency:	84.00	Pump Efficiency:	82.38
Motor Efficiency:	88.00	Overall Efficiency:	72.49
		KWH/1000 gallons:	1.33

Component Weights

Bowl Weight, Lbs.:	258	Column Weight,Lbs.:	0
Head Weight, Lbs.:	0	Can Weight,Lbs.:	0
Motor Weight, Lbs.:	430	Total Pump Weight,Lbs.:	

Version: 2.30P Mount Forest Well No. 5 Date: 07-24-2002

IWS WELL & MAINTENANCE REPORT

10/1C

90706

CONTRACT	JOB NO.	WELL NO.	PUMP NO.
Mt. Forest.	1.MO 29.I	6	~~90607~~
SERVICE TECHNICIAN: Jim Augustine		DATE: May 2/95	
LOCAL ADDRESS		PHONE	

PUMP DESCRIPTION

NO. 90706 — HEAD SHAFT MAT'L. C.S. — DIAM. PIPE 8" [Flgd. Cpld.] — SETTING BP to MB 160'

BOWL SIZE 10 — OUTLET DIAM. 8" — DIAM. TUBING 2 3/8" — LGTH. BOWL 5'-6"

TYPE TLC — IMP. MAT'L. Bronze — DIAM. SHAFT 1 3/16" — LGTH. SUCTION 9'-10"

NO. STAGES 6 — BOWL MAT'L. Cast — LINE SHAFT MAT'L. C.S. — STRAINER —

HEAD — MAX. COL. SECTION 10' — DIAM. SUCTION 8" — LGTH. AIR LINE ..... Mat'l .....

SPECIALS: ZINC SLEEVES [ ]yes [ ]no NO. ..... TAPED OIL LINE [ ]yes [ ]no

OTHER ..... GAUGES: ALT: 0 - ..... ft. PRESS. 0 - ..... psi.

MOTOR DESCRIPTION

9900 410-D-574 R2126 84

MAKE U.S. — R.P.M. 1770 — PHASE 3 — SERIAL NO. ID

TYPE R.O. — FRAME 365 T.P. — CYCLES 60 — UPPER BRG. 7220-M

H.P. 75 — AMPS. 71 — VOLTS 575 — LOWER BRG. 6211-J

STANDBY DRIVE — SPECIAL EQUIPMENT

MAKE GEAR Gonzalez — MODEL ..... — MAKE ENGINE ..... — NO. CYLS. .....

RATIO H/V V/3 — FLEX. SHAFT ..... — MODEL ..... — GOV'D R.P.M. .....

SERIAL C-80 127371 — FLGS. ..... — SERIAL ..... — FUEL .....

WELL DESCRIPTION

DEPTH FROM BASE PLATE 399'-10"

INSIDE DIAM. 13 I.D.

STATIC LEVEL 50'-7 3/4"

SUBMERSIBLE PUMP ONLY — INFORMATION

MAKE OF STARTER ..... SIZE .....

QUICK TRIP OVERLOAD RELAY NO.: .....

3 PHASE PROTECTION YES [ ] NO [ ]

MOTOR WARRANTY CARD COMPLETED [ ]yes [ ]no GIVEN TO .....

PERFORMANCE CHECK

SHUT OFF HEAD: ..... A.G.H. psi. ..... W.L. .....

TIME Date May 2/95	PUMPING RATE Meter [ ] Orifice [ ]	PUMP PRESS. psi.	WATER LEVEL Air Line Tape	R.P.M.	VOLTS	AMPS.
	560 GPMs	71 164'	+ 60' = 224'			1/62
	865 to waste	13 30'	+ 68' = 98'			2/57
	1073					3/57

Pump ends will need turning down (coluemns)
Pump was destaged from 8 to 6 stages to
reduce the High Discharge Pressure.

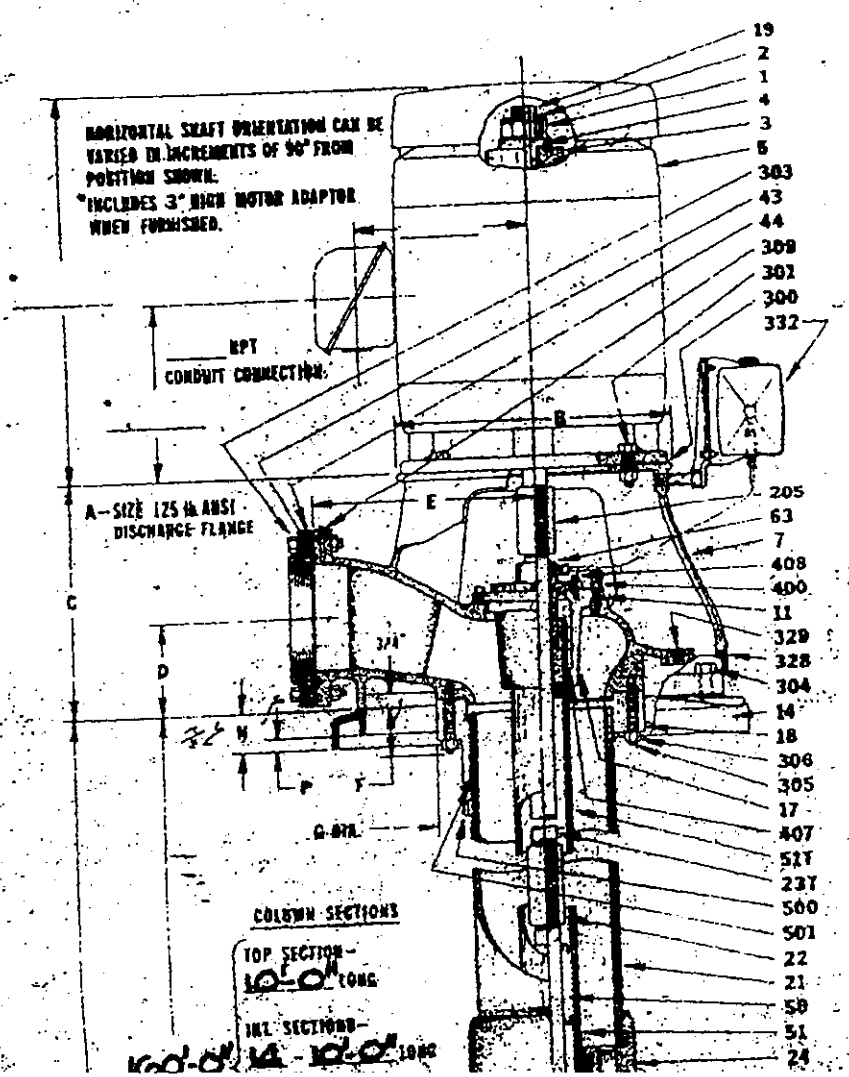
S/N 907066 Wells (1 of 3)

LAYNE & BOWLER, INC.
MEMPHIS, TN 38108 USA

INSTALLATION PLAN & SECTIONAL DRAWING - WELL PUMP

TF HEAD - LAYNE ENCLOSED LINE SHAFT COLUMN - 4x7/8x1-1/4 THRU 10x2-3/16x3-1/2 8DR, PR, RK, T, UR, 10RK, T, U, & 12T BOWLS

USE DIMENSIONS SHOWN ONLY WHEN CERTIFIED BY FACTORY



MOTOR BY CUSTOMER

ITEM NO.	MOTOR DATA
5	MOTOR: V H S. MFGR USEM FRM 365TP 75 HP. 1800 RPM VOLTS 3 PH. 60 HERTZ HIGH THRUST, ENCL WP-1 COUPLING N.E.C.

NOT APPLICABLE SEE DRAWING NO.

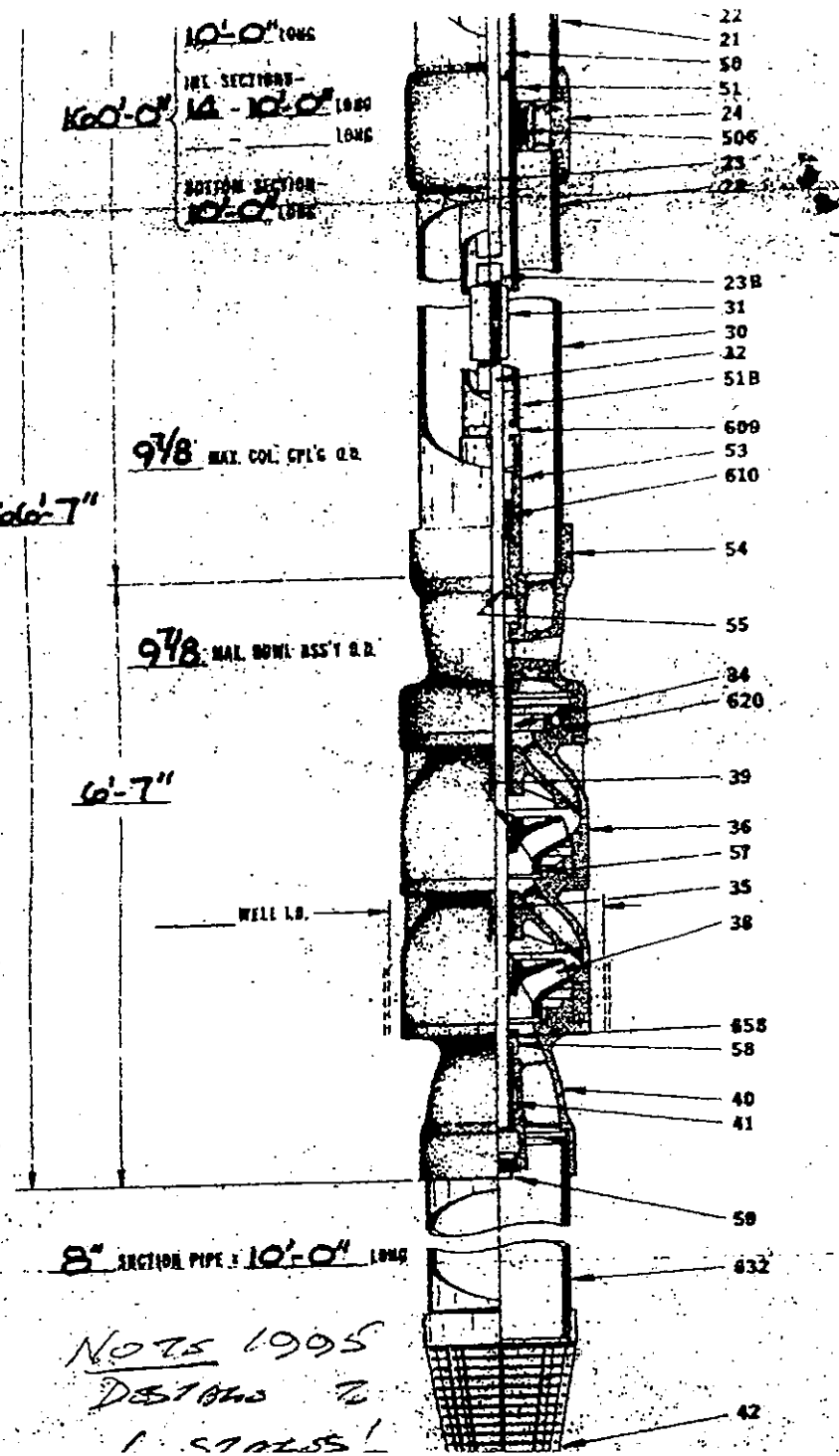
ITEM NO.	PART NAME	MATERIAL STD	MATERIAL OPTIONAL
19A	DRIVE SHAFT ASSY	----	
1	ADJUSTING NUT	BRONZE	
2	LOCKSCREW	STEEL	
3	CLUTCH (W/MOTOR)	STEEL	
4	CLUTCH KEY	STEEL	
19	DRIVE SHAFT	STEEL	
206	HEAD COUPLING	STEEL	
7A	DISCHARGE HEAD ASSY	----	
7	DISCHARGE HEAD	C.I. CL 30	
◆ 14	BASE PLATE	C.I. CL 30	
◆ 45	TUCKPACKING, 3/8 SQ.	RUBBER	
◆ 44	COMPANION FLANGE	C.I. CL 30	
▲ 309	MOTOR ADAPTOR	C.I. CL 30	
301	MACH BOLT, DRIVER/HD	STEEL	
◆ 303	MACH BOLT, CONN FLG/HD	STEEL	
304	CAPSCREW, HD/B-P	STEEL	
305	STUD, TOP COL. PLG/HD	STEEL	
306	HEX NUT TOP CL FLG/HD	STEEL	
200	PLUG, GAUGE CONN (TYP)	C.I.	
328	DRAIN CONN. 1/2 NPT		
329	AUX OPENING - SEE INSET BELOW		
332	LUBRICATOR ASSY. SEE DRWG 861-L01A		
17A	STUFFING BOX ASSY	----	
□ 11	GASKET, TEN BOX/HD	----	
17	TENSION BOX	C.I. CL 30	
63	TENSION BEARING	BRONZE	
400	CAP SCREW, ST. BOX/HD	STEEL	
407	O-RING	RUBBER	

ALTERNATE CONSTRUCTION

NOT APPLICABLE SEE DRAWING NO.

NOT APPLICABLE SEE DRAWING NO.

NOT APPLICABLE SEE DRAWING NO.



□	11	GASKET, TEN BOX/HD	----	
	17	TENSION BOX	C.I. CL 30	
	63	TENSION BEARING	BRONZE	
	400	CAP SCREW, ST. BOX/HD.	STEEL	
	407	O'RING	RUBBER	
	408	LOCK SCREW	STEEL	

NOT APPLICABLE SEE DRAWING NO. ____

	51B	COMPLETE COL ASSY	----
●	18	TOP COLUMN FLANGE	C.I. CL 30
●	600	PACKING RING	----
●	601	LAMPWICK PACKING	----
	21	TOP PC. COL. PIPE	STEEL
	22	LINE SHAFT COUPLING	STEEL
	23	LINE SHAFT	STEEL
	23B	BOT. PC. LINE SHAFT	STEEL
	23T	TOP PC. LINE SHAFT	STEEL
	24	COLUMN COUPLING	C.I. CL 30
	28	COLUMN PIPE	STEEL
	30	BOT PC. COL. PIPE	STEEL
	50	LINE SHAFT BEARING	BRONZE
	51	ENCLOSING TUBE	STEEL
	51B	BOT. PC. ENCL. TUBE	STEEL
	51T	TOP SPL. ENCL. TUBE	STEEL
	506	SPIDER BUSHING	RUBBER

NOT APPLICABLE SEE DRAWING NO. ____

	660	BOWL ASS	----
	31	IMP. SHAFT COUPLING	STEEL
	32	IMPELLER SHAFT	410SS
	34	BEARING, TOP INT.	BRONZE
	36	BEARING, INT.	BRONZE
	38	INTERMEDIATE	C.I. CL 30
	38	IMPELLER	BRONZE
	39	COLLET	STN. STL.
	40	SUCTION CASE	C.I. CL 30
	41	BEARING, SUCTION	BRONZE
◆	42	CONE STRAINER	STEEL
	65	TUBE ADAPTOR	STEEL
	54	DISCHARGE CASE	CI. CL 30
	55	OIL SEAL (2)	RUBBER
	57	WEAR RING	BRONZE
	58	SAND COLLAR	BRONZE★
	59	SUCTION PLUG	C.I.
	609	MAIN BEARING	BRONZE
	610	BEARING, TUBE ADPTR.	BRONZE
△	620	O'RING, BOWL	RUBBER
◆	632	SUCTION PIPE	STEEL
	658	SET SCREW, COLLAR	STN. STL.

NOT APPLICABLE SEE DRAWING NO. ____

◆ OPTIONAL – FURNISHED ONLY WHEN SPECIFIED.

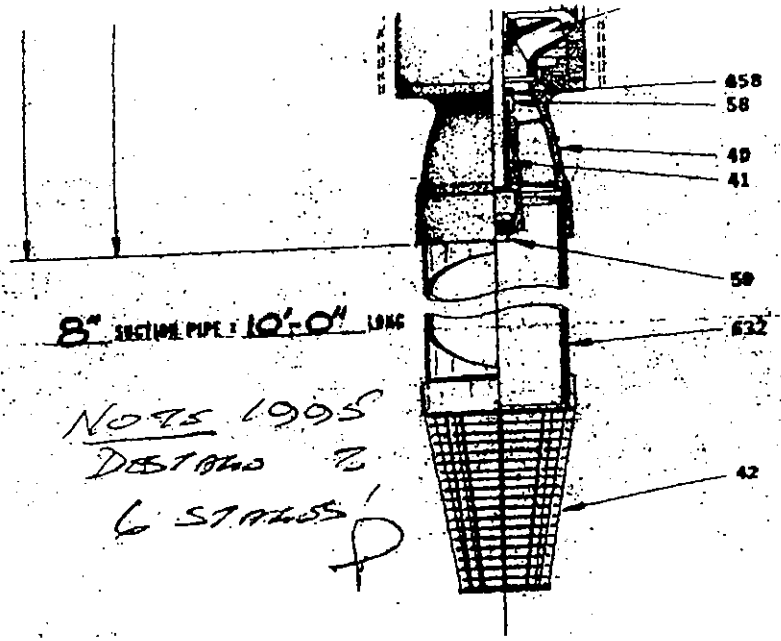
△ NOT SHOWN – OPTIONAL – FURNISHED WHEN SPECIFIED OR WHEN REQUIRED DUE TO DRIVER BASE SIZE.

□ OPTIONAL – FURNISHED WHEN SPECIFIED OR WHEN OPERATING PRESSURE IS 250 PSI OR GREATER

● THE ADJUSTABLE - TYPE TOP COLUMN FLANGE WITH PACKING RING AND LAMPWICK PACKING IS FURNISHED FOR SETTINGS OF 200 FT. OR GREATER. OPTIONAL FOR SETTINGS LESS THAN 200FT.

NOTE 1995
DESIGNED TO
1 STAGES!

3 of 3



8" SECTION PIPE : 10'-0" LONG

NOTE 1995
DESIGNED TO
6 STAGES

53	TUBE ADAPTOR	STEEL	
54	DISCHARGE CASE	CI. CL 30	
55	OIL SEAL (2)	RUBBER	
57	WEAR RING	BRONZE	
58	SAND COLLAR	BRONZE*	
59	SUCTION PLUG	C.I.	
806	MAIN BEARING	BRONZE	
810	BEARING, TUBE ADPTR.	BRONZE	
△ 820	O RING, BOWL	RUBBER	
◆ 832	SUCTION PIPE	STEEL	
858	SET SCREW, COLLAR	STN. STL.	

◆ OPTIONAL – FURNISHED ONLY WHEN SPECIFIED.

▲ NOT SHOWN – OPTIONAL – FURNISHED WHEN SPECIFIED OR WHEN REQUIRED DUE TO DRIVER BASE SIZE.

□ OPTIONAL – FURNISHED WHEN SPECIFIED OR WHEN OPERATING PRESSURE IS 250 PSI OR GREATER

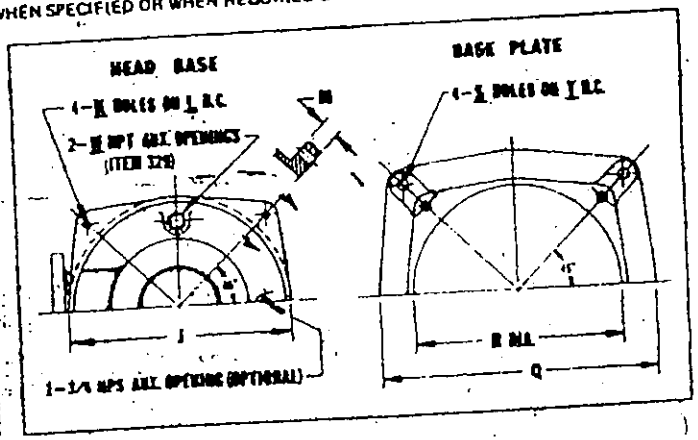
● THE ADJUSTABLE TYPE TOP COLUMN FLANGE WITH PACKING RING AND LAMPWICK PACKING IS FURNISHED FOR SETTINGS OF 200 FT. OR GREATER. OPTIONAL FOR SETTINGS LESS THAN 200 FT.

★ MAT'L – RUBBER ON ALL 8" BOWLS – NO SET SCREW (ITEM NO. 858) REQUIRED.

△ OPTIONAL – FURNISHED WHEN SPECIFIED OR WHEN REQUIRED BY BOWL PRESSURE LIMITATIONS.

ALL DIMENSIONS IN INCHES

HEAD	A	B	C	D	E	F	G	H	HEAD BASE J	K	L	M	BASE PLATE N	P	Q	R	S	T
TF413	4	17	13	6	11	3	10	1	18	11/16	20	1 3/8	2	1/2	21	17	7/8	24
TF413-17	4	17	13	6	11	3	10	1	18	11/16	20	1 3/8	2	1/2	21	17	7/8	24
TF613	6	13	14	6	11	4	11	1	18	11/16	20	1 3/8	2	1/2	21	17	7/8	24
TF613-17	6	17	14	6	11	4	11	1	18	11/16	20	1 3/8	2	1/2	21	17	7/8	24
TF818	8	18	16	6	14¼	4	12¾	1	25	13/16	24¼	2 1/4	2¾	3/4	26¼	21¼	7/8	28 3/8
TF818	8	18	18	7 1/8	14¼	4	13¾	1	31	13/16	33¾	2 1/4	3¾	1	26¼	21¼	7/8	28 3/8
TF825	8	25	20	8 1/8	18¼	4	16	1½	25	13/16	24¼	2 1/4	3¾	1	38	29	1	41
TF1018	10	18	18	8 1/8	18¼	4	16	1½	31	13/16	33¾	2 1/4	3¾	1	32	24	7/8	33 1/2
TF1026	10	25	20	8 1/8	18¼	4	16	1½	25	13/16	24¼	2 1/4	3¾	1	38	29	1	41
TF1218	12	18	20	9 5/8	18¼	4	19	1	28	13/16	27¾	2 1/4	3¾	1	38	29	1	41
TF12254	12	25	24	9 5/8	18¼	5	21	1½	31	13/16	33¾	2 1/4	3¾	1	38	29	1	41



CUSTOMER: MT. FOREST UTILITY COMM.
JOB NAME:
LOCATION: MT. FOREST, ONTARIO, CANADA
APPLICATION:
CONSULTING ENGR.: DATE:
FOR APPROVAL: DATE: 5/31/79
CERTIFIED:

HEAD NO: TF818 W/125 LB. DISCH. 10" BASE — MOT. ADPTR.
COLUMN SIZE: 8" x 2" x 13/16
BOWL SIZE & MODEL: 10" TLC
NO. OF STG'S: 8 TEMP:
GPM: 720 RPM: 1800
TDH: 304' BHP: 67

CUSTOMER NO: T90510
REF. JOB NO:
REF QUOTE NO:
SALES ORDER NO: T9D3744
PUMP SERIAL NO: 907096

DWG T9D3744

SECTION 3100
DRWG NO: 1120-P41A
DATE: Feb. 1. 1979
SUPERSEDES:

Printed in U.S.A.

9/10

2 of 3

PUMP DESTAGED FROM 8 STAGES IN 1995 SN 90706

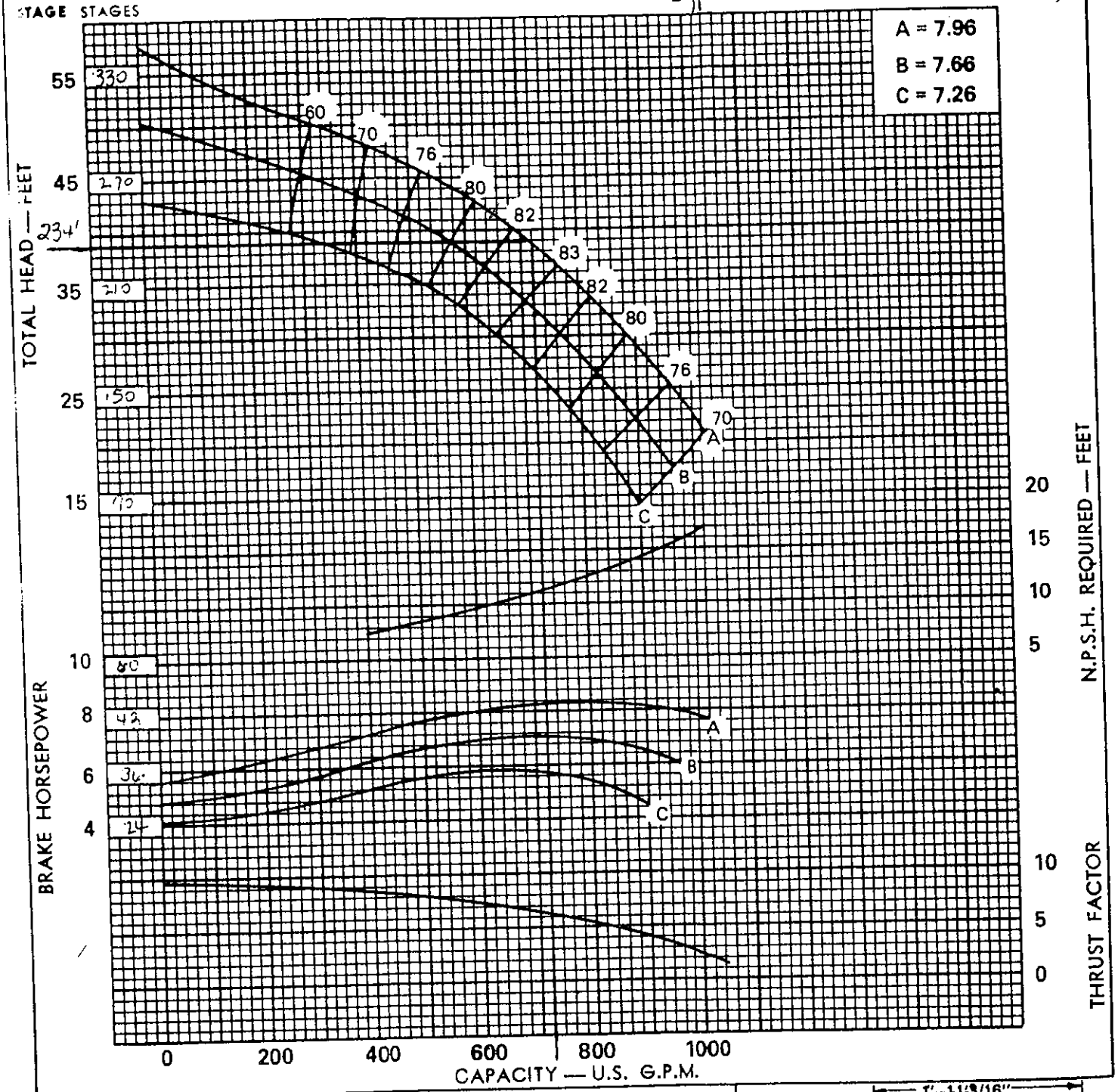
CURVE NO.	No. Stages	Eff. Change	MATERIAL	Eff. Change
18-091	1	−3	IMP.—C.I.	−1
6-1-77	2	−2	IMP.—NI-RI	−1
	3	−1	BOWL—BRZ.	-1
	4	0	BOWL—NI-R.	-1

10 TLC — 1760 R.P.M.

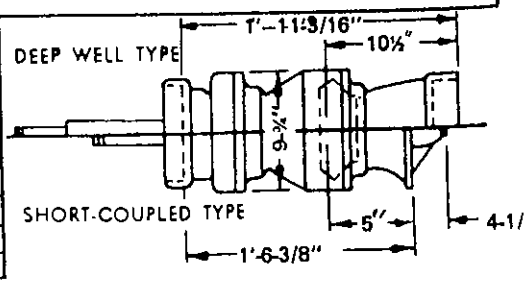
SINGLE STAGE LAB PERFORMANCE WITH STANDARD MATERIALS. EFFICIENCY SHOWN FOR 4 OR MORE STAGES. HORSE POWER SHOWN FOR ONE STAGE BASED ON 4 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.

ONE STAGE (6) STAGES

WELL No 4 720 USgpm @ 304' (ORIGINALLY)



EYE AREA — SQ. IN.	= 16.53		IMPELLER WT.-LBS.	= 13.9	
WR² PER IMPELLER	= 0.63	LB.-FT.²	ONE STAGE WT.-LBS.	= 200	
MAX. SPHERE SIZE	= 0.625	in.	ADD'L STAGE WT.-LBS.	= 73	
MAX. NO. STD. STAGES	= 18		IMPELLER NUMBER	= 5T13	
MAX. OPERATING P.S.I.	= 450		DISCH. SIZES	= 6,7,8	
STD. LATERAL	= 0.44	in.	SUCTION SIZES	= 8	
STD. SHAFT DIA.	= 1.500	in.	MAX. LATERAL	= 0.76	in.
MAX. SHAFT DIA.	= 1.687	in.	BOWL CONN.	THREADED-COLLET	
MIN. SUBMERGENCE	= 26	in.	ADD 7-3/8	" PER ADDITIONAL STAGE.	



INTERNATIONAL WATER SUPPLY LTD

Groundwater Development – Drilling Services
Pumps – Water Treatment – Service & Maintenance

342 Bayview Drive, P. O. Box 310
Barrie, Ontario, Canada L4M 4T5
Tel:705-733-0111 *800-461-9636 * Fax: 705-721-0138
Email: iws@iws.ca www.iws.ca

Jan 28, 2013

Township of Wellington North
P.O. Box 125
7490 Sideroad 7 West
Kenilworth, ON
N0G 2E0

Attention: Barry Trood
Public Works Manager

Reference: Mount Forest Well No 4
Pump Maintenance, Layne S/N 47651

As authorized, International Water Supply Ltd. (IWS Ltd.) has completed well pump maintenance at Mt. Forest Well No. 4. The following is a report of the work completed.

Background

Mt. Forest Well No. 4 was constructed by IWS Ltd. in 1962. It was constructed as a nominal 14 inch (350 mm) diameter rock well cased and sealed through the upper sedimentary limestone/dolomite bedrock to a depth of approximately 194 ft (59 m). Open hole in the rock extended to a depth of 401 ft (122 m).

The well was equipped in 1963 with a Layne, oil lubricated style vertical turbine pump driven by a 30 hp USEM electric motor. The pump has been serviced in 1983 and in 1995 when the shaft oil was changed to food grade.

Well Performance testing has been completed in 1962, 1983, 1995 and 2000. In June 2010 a performance test conducted into the system at the normal operating rate of 237 IGM (18 L/s). After one hour 30 ft (9.1 m) of drawdown was observed indicating well performance was similar to that observed in 1983 and 1962 when the well was originally tested. Thus no well maintenance rehabilitation work was recommended.

Pump Maintenance

The pump was removed from the well on August 21, 2012. The pump components were found to be in fair to satisfactory condition and with maintenance could be reinstalled. The conversion of the pump to water lubrication, as had been done in 2011 to Well No. 6 was recommended and authorized.

The bowl assembly was serviced with a set of bronze bowl bushings and wear rings. The cast discharge case was changed to water lube style and the impeller shaft shortened.

Most of the steel column pipe was reused with water lube style cast combination couplings installed. Three pieces of pipe were corroded and required replacement, one pipe was used to machine into top and bottom special lengths. 150 ft of the 416 stainless steel, 1 inch diameter, shafting with stainless wear sleeves was supplied. Each column pipe was painted with an NSF protective coating and fitted with sacrificial zinc anode rings.

The tension box assembly was replaced with a stuffing box and packing assembly. As completed at Well No. 6 in 2011, Wellington North staff installed a pre-lube line controlled by a timer-relay installed in the motor control. This provides a pre-lube of pressure water to the shaft bearings above the static water level prior to the pump starting.

The 30 hp VHS motor was steam cleaned/baked and serviced with new bearings and oil.

The well and pump were disinfected and re-installed on October 11, 2012. The pump was then operated to waste to permit water sampling and to check its operation.

After approximately one month, an abnormal rumbling noise/vibration was noted on startup and shutdown. Initially it was not determined what the source of the vibration could be. The motor, the Benshaw motor controller and a possible bent shaft were suspected. It was decided to pull the pump and disassemble for a detailed inspection. Nothing obvious was found however, it was decided to replace the bowl impeller shaft as a precaution.

The pump was disinfected and reinstalled on November 26, 2012. The pump was operated to waste the next day and operated into the system on December 3, 2012. The ramp up speed of the Benshaw motor controller was shortened from 15 seconds to 5 seconds. The pump operated well.

On January 9, 2013 the noisy/vibration was noted again. It appeared to be a concern on shut down when the pump was permitted to reverse rotate after stopping. The older style VHS motor was not equipped with a non-reverse ratchet assembly which is commonly used today.

On January 16, 2013 the operation of the pump was checked by our Senior Installer and Field Engineer. It is suspected that the pump operates briefly at its natural frequency of

vibration, or resonance speed, during the short ramp-up time of 5 seconds and the same speed frequency is reached during the backward rotation. In order to prevent this a non-reverse ratchet assembly was fitted to the top of the VHS motor. The pump operation was repeatedly checked again without any excessive noise/vibration noted. Vibration readings were taken and found to be within the acceptable limits in all three planes per the Hydraulic Institute Standards.

This application does not require an extended ramp –up or down time on the pump during start-up or shut down. It is recommended that these settings be changed to 3 to 5 seconds maximum.

Well Video Inspection

A well video inspection of Mt. Forest Well No. 4 was conducted on August 30, and September 11, 2012. A DVD copy is enclosed for reference. The following observations were made;

- All measurements are recorded in feet with the top of the pump base used as the reference point.
- A small temporary pump was installed to clarify the standing water in the well.
- The static water level was observed at approximately 60 ft (18.3 m). Some residual oil was observed. This was subsequently removed.
- The 12 inch (300 mm) diameter steel casing extended to approximately 191 ft (58.2 m). The casing appears to be in satisfactory condition. Most welded casing joints were not visible due to a carbonate mineral scale coating on the casing interior below the static water level. The scale is heavier below 90 ft, down to 175 ft, below the pump suction. Wire brush cleaning should be considered at next servicing.
- During the video inspection of August 30, 2012 a piece of debris blocked the rock bore at 198 ft. This was suspected to be a rock fragment or piece of carbonate scale. An attempt to dislodge the debris caused the weighted sounding line to jam in the rock bore. The crew returned on September 11, 2012 to dislodge the debris and drive the weighted sound line to the well bottom. The video inspection was then completed.
- The limestone/dolomite rock bore contains numerous fractures, voids and 'vuggy' reef structure zones throughout its length. Other sections of the rock bore are smooth. The fracture/vuggy zones would be the water producing zones. Below the depth of 345 ft (105 m) visibility is poor indicating that little water production comes from below this depth.

- A small piece of debris, possibly a short steel bar, was observed at 285 ft. It does not present a concern.

- The clear depth of the well was found to be approximately 386 ft (118 m) indicating that there appears to be approximately 15 ft (4.5m) of rock and/or soft mineral debris in the bottom of the well. This is not a concern to the production capacity of the well.

Attached for reference are the Video Well Technician's notes and four video images from the inspection.

Conclusions and Recommendations

1. The conversion of the lineshaft pump from oil lubrication to water lubrication has been successfully completed. A pre-lube water supply now lubricates the shaft rubber bearings above the static water level prior to start up.

2. A non-reverse notched assembly has been added to the VHS motor to prevent resonance harmonic vibration during shut down. The Benshaw motor control ramp up and down settings need to be set to 3 to 5 seconds maximum to avoid resonance.

3. Well and Pump Performance testing should be conducted in 4 to 5 years. This should be in advance of the next scheduled pump maintenance work in 5 years.

4. Regular recording of production, water levels, and above ground head should be maintained in order to monitor any changes in well or pump performance.

5. At next servicing the well casing should be swabbed with a wire brush to remove mineral scale and the well should be video inspected to re-assess the casing condition.

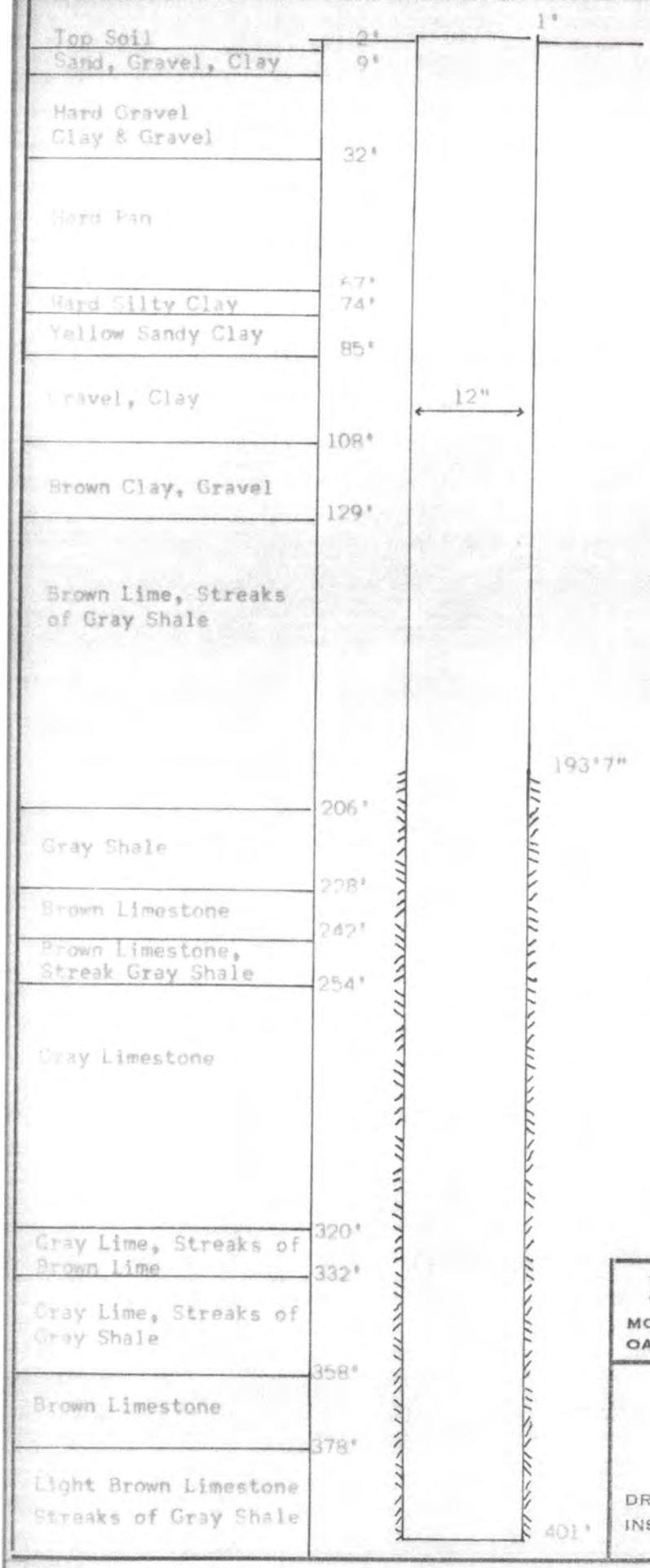
6. Should any well maintenance rehabilitation work be necessary in the future, an attempt to remove the accumulated debris from the bottom of the well can be made at that time.

Should you have any questions, please do not hesitate to contact us.

Regards,

John A. Harris, P.Eng.

JAH/ww



Well Material

Outer Casing 194'7" of 12" welded

Inner Casing

Screen

Plug

Gravel

Pump

No. 47651 **Setting BP-MB** 150'

No. Stages 7 **Length Bowl** 6'1"

Bowl 10" RKLC **Size & Lgth. Suction** 10'

Head SDH **Size Column** 6" x 1½" x 1"

Materials or setting details other than standard:

Impellers: Trim

Motor

Make	U.S.E.M.	**Phase**	3
H. P.	30	**Cycles**	60
R. P. M.	1800	**Volts**	220
Type	RU	**Amps.**	76
Frame	A326UP	**Serial**	3520758

Bearing Nos. Upper - 7218.BY
Lower - 6210.J

Special Equipment

1 - 200# Pressure Gauge
1 - 200' Altitude Gauge

Well No. 4

B. P. referred to original ground level 3'5"

Clear depth below B. P. 397'7"

Started 15 Oct., '62 **Final Test** Sept. 26/63

Preliminary Test Nov. 20 **Static Level** 46'6"

Final Test _____ **Pumping Level** _____

Guarantee _____ I G P M Capacity _____ I G P M

Contract Pressure _____ # Pressure Pump _____ #

Length Air Line 166' Main _____ #

INTERNATIONAL WATER SUPPLY LTD.

MONTREAL OAKVILLE — LONDON, CANADA — WATER SUPPLY CONTRACTORS — SASKATOON VANCOUVER

PUBLIC UTILITIES COMMISSION, MOUNT FOREST, ONT.

DRILLED BY C. A. Muxlow DRAWN BY ms

INSTALLED BY G. Keyes APPROVED BY

Well Video Inspection Report

Township of Wellington North
Mount Forest Well No. 4
August 30 and September 11, 2012

Contract: Mt. Forest Well No. 4		WELL No: 4	DATE: Sept 11/ 2012
		PUMP No:	KMS:
Employees on Site		Water Level Data	
Quinn Cooper		Static Water Level : 60 ft	
Dale Augustine		Measuring Point : Pump Base	
Terry Brown			

WELL DESCRIPTION

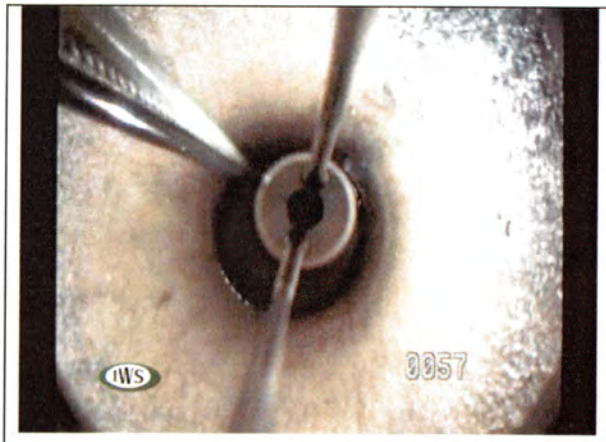
Depth ft	Depth m	CASING JOINTS CONDITION	CASING/WELL CONDITION	SCREEN CONDITION
20	6.1	OK	Minor scale, corrosion/pitting	
40	12.2	OK	Minor scale, corrosion/pitting	
			Jt. Near SWL not visible, some residual oil	
82?	25		Carbonate build up below SWL, heavier below 90 ft to 175 ft	
		None visible	Pump bowl rub on csg at 163 ft	
191	58.2		Bottom of casing shoe	
194	59.1		Large void	
197	60		Refusal (Aug 30)	
216-258	66-79		Vuggy with voids	
278-285	85-87		Large void – short steel bar?	
290-293	88-89		Crevices	
297-307	91-94		Smooth -no fractures	
308	93.9		Fracture	
320	97.5		Vuggy sections	
343	104.6		Vuggy sections	
350	106.7		Reduced visibility begins, mineral/bio floc	
352	107.3		Fracture	
386	117.7		Lights out, soft debris	Well bottom

NOTES:

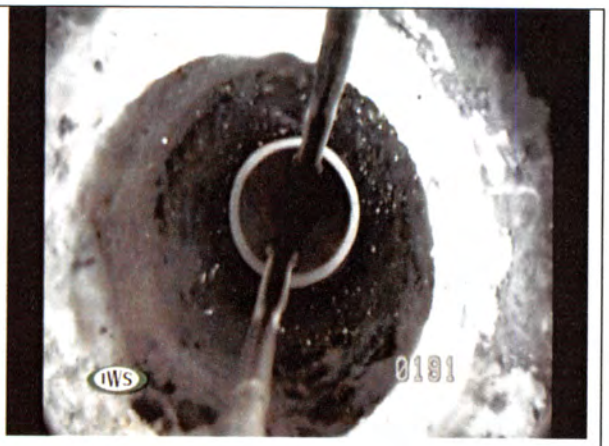
Horizontal View depth is approximately two feet greater than the Vertical View

Well Video Inspection Report

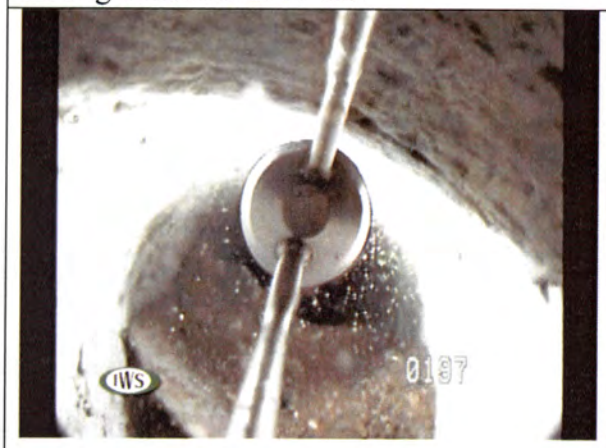
Township of Wellington North
Mount Forest Well No. 4
August 30 and September 11, 2012



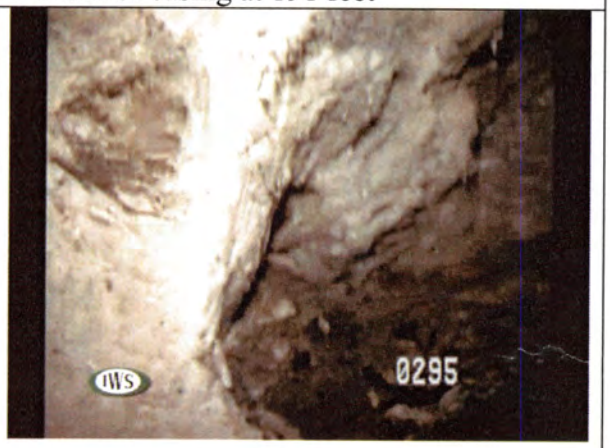
Casing condition at 57 feet



Bottom of casing at 191 feet



Vertical view of refusal at 197 feet



Horizontal view of crevice at 295 feet.

INTERNATIONAL WATER SUPPLY LTD.

Groundwater Development – Drilling Services
Pumps – Water Treatment – Service & Maintenance
342 Bayview Drive, P. O. Box 310
Barrie, ON
L4N 4Y8
Tel:705-733-0111 *800-461-9636 * Fax: 705-721-0138
Email: iws@iws.ca www.iws.ca

Jan 25, 2012

Township of Wellington North
P.O. Box 125
7490 Sideroad 7 West
Kenilworth, ON
N0G 2E0

Attention: Barry Trood
Public Works Manager

Reference: Mount Forest Well No. 6
Pump Maintenance

As authorized, International Water Supply Ltd. has complete well pump maintenance at Mt. Forest Well No. 6. The following is a report of the work completed.

Background

Mt. Forest Well No. 6 was constructed by IWS Ltd. in 1979. It was constructed as a nominal 14 inch diameter rock well, cased to approximately 200 ft (61m) and open borehole in the rock to a depth of 400 ft (122m). The well was equipped with a Layne, oil lubricated style vertical turbine pump driven by a 75 hp USEM electric motor and a combination right angle gear drive providing standby power through a tractor PTO. The pump had been serviced in 1989 and 1995 when the bowl was de-staged from 8 to 6 stages to reduce pressures.

Performance testing conducted in 2010 showed some deterioration in well performance. Well rehabilitation was not warranted at this time. The well is normally operated at approximately 50% of its rated capacity, 23.5 L/s (310 IGM). This is reportedly due to elevated sodium concentration at higher production rates.

Pump Maintenance

The pump was removed from the well on August 23, 2011. The pump was found to be in very poor condition. Bowl castings were softened by graphitization. Column pipe and couplings were severely corroded. The pump components were determined to be not serviceable and required replacement.

Following the removal of the pump and residual lubricating oil from the well a borehole video inspection was conducted. This was reported separately on October 17, 2011.

After considering various options for re-equipping the well a new Goulds water lubricated style vertical turbine pump and column assembly, to match the previous equipped capacity, was authorized by the Township of Wellington.

The new pump is a Goulds Model 11 CMC-4 stage bowl assembly for 45.5 L/s @ 72m TDH (720 US GM @ 236 ft). The bowl is set on 160 ft of 8" x 1 3/16" column assembly, complete with stainless steel shafting and sleeves running inside bronze bearing retainers at each sleeve coupling joint. A set of sacrificial zinc sleeves were also installed. A new water lubricated stuffing box was installed in the discharge head.

Due to the 50 ft (16m) static water level a pre-lube water supply was recommended for startup. The Township installed the pre-lube line, controlled by a timer-relay in the motor control. The 75 hp VHS motor was serviced at a motor shop.

The well and pump were disinfected, installed and then started to waste on Dec 2, 2011. A new Pump Operation and Maintenance Manual which includes a pump performance curve and our Installer's Maintenance Report was provided to the Township.

Recommendations

1. Well and pump performance testing should be conducted in 4 to 5 years. This should be in advance of the next scheduled pump maintenance work in say, 5 years.

2. Regular recording of production, water level, and above ground head should be maintained in order to monitor any changes in well or pump performance.

3. At next servicing the well casing should be swabbed with a wire brush to remove mineral scale and the well should be video inspected to asses the casing condition.

4. Consideration should be given to removal of the approximate 5 ft of accumulated debris at the bottom of the well and to conducting Borehole profiling and discrete zone sampling to determine water production zones and possible source of elevated sodium.

Should you have any questions, please do not hesitate to contact us.

Regards,

John A. Harris, P.Eng
JAH/ww

Well Initiatives Limited 7461 County Road 18, P.O. Box 416, Elora Ontario Canada N0b 1S0
telephone (519) 846 8289 **fax** (519) 846 8281 **web** info@wellinitiatives.com

WELL INITIATIVES

March 22, 2011

Via: Email and Mail

Mr. Gary Williamson
Township of Wellington North
7490 Sideroad 7 West
P.O. Box 125
Kenilworth ON N0G 2E0

Dear Mr. Williamson:

Re: Rehabilitation of Mount Forest Well 3
Mount Forest, Ontario
Township of Wellington North
File No.: VA0355680.0000

Well Initiatives was contracted to complete well rehabilitation activities on Mount Forest Well #3. This report summarizes the work process and current condition of the well.

The Mount Forest Well 3 was originally drilled in the 1950s and equipped with a pump in 1956. The well was constructed in the upper portion of the bedrock aquifer. In 2005, Mount Forest Well 3 was reconstructed to reduce its depth to approximately 70 m to eliminate a non-productive sump in the bottom of the well. At the same time the well was equipped with a submersible pump to replace the over 40 year old line shaft turbine pump. In 2010 the Township of Wellington North staff reported that the well was not able to maintain its typical capacity in the range of 15 to 18 L/s. Testing completed in June 2010 indicated that the efficiency of Well 3 had declined to less than 70% of the efficiency documented in 2004 and 2005. As per industry standards and considering that the desired capacity of the well was no longer attainable rehabilitation was recommended.

In November 2010 Well Initiatives Ltd. mobilized to the site to complete well rehabilitation using physical and chemical methods. Initial video logging of the well indicated that the location where the steel casing is sealed in the top of the bedrock was somewhat cavernous and corroded. We note that our previous work on the well indicated that approximately 60% of the water producing zones occur within 1.5 m of the bottom of the casing. Subsequently we designed the rehabilitation program to focus on the lower portion of the well, as aggressive rehabilitation near the base of the casing

could result in significant sediment production, rendering the well useless for municipal supply.

The Mount Forest Well 3 was air lift pumped and surged to remove sediment and to clean loose soft sediment mineral deposits that have built up on the inside of the well and water producing fractures in the bedrock. A packer was then installed in the well at a depth of approximately 50 m to protect the well casing from the acid. Hydrochloric acid was then injected into the well to dissolve the mineral deposits within the well that were considered to be plugging and hopefully enlarge the solution features in the bedrock. The well was then air lift pumped and surged with the packer and without the packer in place to remove a considerable quantity of sediment that was a result of the acidification process.

We have reviewed the data from previous tests of Well 3 as well as before and after the latest well rehabilitation program, a graph of the data is attached as Figure 1. This graph shows the amount of water level drawdown or decline at given pumping rates after 20 minutes of pumping. The lower the line on the graph the lower the efficiency of the well.

Following the well rehabilitation, the well was step tested in a similar manner as in June 2010 to document the improvement of the well rehabilitation. The attached Figure 1 indicates that the well efficiency has been returned to the slightly better than the level observed in 2004. This improved efficiency is attributed to the enlargement of the fractures/solution features below 50 m in the bedrock during acidification.

It is interesting to note that the static water level is lower than that measured in 2000 by about 3 m. This variable static water level is noted on the graph and may be a reason for the reduced capacity of the well. A reduction of 3 m of water in the well would reduce the capacity of the well by 3 to 4 L/s.

Mount Forest Well 3 is over 50 years old and is showing signs of its age. The well casing is significantly corroded and the area at the bottom of the well which produces water had to be protected to prevent failure of the well due to the rehabilitation process. The poor condition of the casing and the water producing interval located at the base of the casing makes this well a poor candidate for a liner installation. Mount Forest Well 3 is currently suitable to be used in the municipal system but should be considered for replacement in the near future to avoid problems with sediment production that may begin to occur as the metal at the bottom of the well casing continues to corrode.

We trust that this report is suitable. If you have any question please do not hesitate to call.

Yours truly,

Well Initiatives Inc.

Dwayne Graff
President

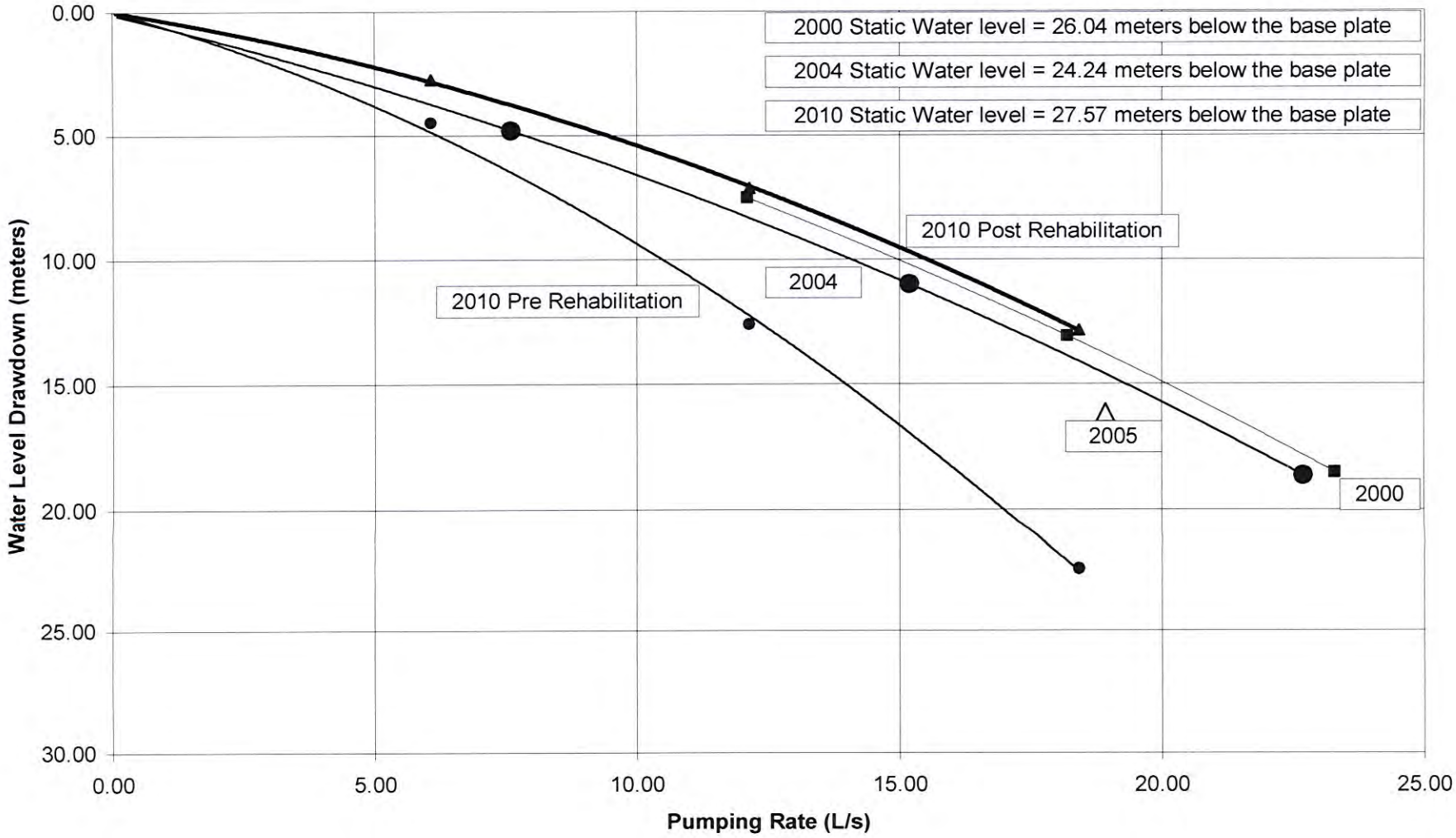
Jim Baxter, P.Eng.
Groundwater Resource Engineer

Enc.

Cc: Barry Trude, Township of Wellington North

110321 Williamson.doc
22/03/2011 10:25 AM

Figure 1: Pumping Rate versus Drawdown
Mount Forest Well 3: Variable Rate Step Test - 2010



R.J.Burnside and Associates Ltd.
File: 018454 Mount Forest Well 3 performance step test 2011 .xls
Prepared by: J. Baxter

Township of Wellington North
Mount Forest Well 3
MO 02 2762.1

Well Initiatives Limited 7461 County Road 18, P.O. Box 416, Elora Ontario Canada N0b 1S0
telephone (519) 846 8289 **fax** (519) 846 8281 **web** info@wellinitiatives.com

WELL INITIATIVES

November 30, 2018
Ref: 300043489

Township of Wellington North
Water & Sewer Department
PO Box 215, 7490 Sideroad 7 West
Kenilworth, ON N0G 2E0

Attention: Mr. Corey Schmidt
Private and Confidential

RE: Mount Forest #5

Introduction

Well Initiatives Limited (WIL) was awarded and completed a well maintenance program for Mount Forest #5. This report documents the work completed on the well during the period of November 7 - 28, 2018.

Background

The well was originally constructed as a 300 mm (12" diameter) bedrock well with an original finished depth of 122 m (400') in 1968 by International Water Systems (IWS). This well is one of the supply wells for the town of Mount Forest water system. The lower portion of the well was abandoned and filled to a depth of 42.7 m (140') in 2002 by IWS due to the lower portion of the well being unproductive.

Work Program

We mobilized to the site on November 7 and conducted a variable rate test using the clients pumping assembly. The water for the test was directed through the flow to waste and then into the catch basin located in front of the pump house. Flow rates were measured using a WIL supplied calibrated digital flowmeter placed in line between the flow to waste and the catch basin. Flow rates used were 15, 30 and 45 L/s. The well was operated at each flow rate for 30 minutes followed by 30 minutes of recovery with water levels taken at regular intervals. On the same day the pumping assembly was removed from the well. A copy of the pumping data has been included as Table 1. This data has also been plotted and included as Figure 1 and 2.

We returned on November 13 and performed a static and pumping video inspection of the well. The column pipe and pumping assembly were also pressure washed on this day. A copy of this video and video summary has been included as Table 2.

On November 27 the well was chlorinated to an initial concentration of 200 mg/L using 47% granular sodium hypochlorite mixed into a solution. After the solution was added to the

well the well was circulated with a small submersible for a period of 1 hour before the permanent pump was reinstalled. On November 28 the well was operated to waste. The initial discharge was contained in WIL's 9,000 settling tank and neutralized before being discharged to the natural environment. Initial discharge had a chlorine concentration of >100 mg/L. Samples were collected and submitted by the county for bacteriological analysis.

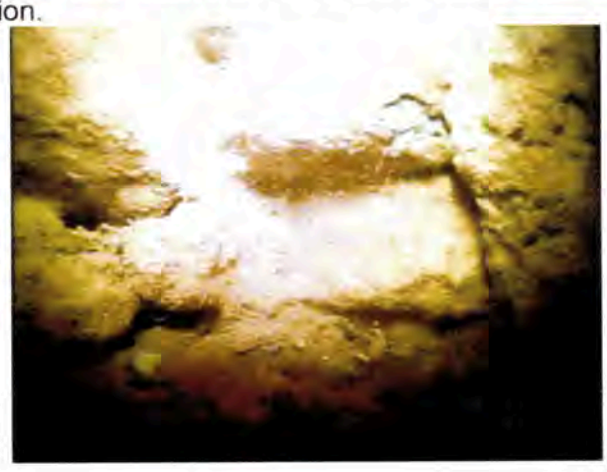
Testing Results

When this well was new it had a reported specific capacity of 3.26 L/s/m at a flow rate of 25.2 L/s. There was no well performance data available from the well reconstruction completed in 2002, which would have lowered the specific capacity when the bottom of the well was filled in. Data from the testing indicates that the specific capacity is currently 3.19 L/s/m at a flow rate of 30.5 L/s. When the well was operated at 45 L/s the specific capacity was observed to be 2.59 L/s/m. The pump was operated in VFD mode for the duration of the testing. At the high rate the pump performance was close to the factory curve. Current draw measured during pumping also indicates that the motor is operating at or close to factory specifications. No well rehabilitation was warranted at this time since the well is currently operating very close to its as constructed efficiency.

During the testing we noted the VFD ramp time was operating outside the motor manufactures specifications. The motor requires that the motor speed be set to be operating at 30 Hz in one second. We observed the motor ramp times taking approximately 7 seconds to reach 30 Hz. Operating the motor with slow ramp times will shorten the life of the motor due to improper lubrication of the internal bearings in the motor.

Video Inspection

A static and pumping video inspection of the well was completed. The reference point for the video inspection was the surface of the pump house floor. The video inspection revealed that the bottom of the visible well is less than the overall depth reported in 2002 when the lower portion of the well was filled in. The well record completed by IWS indicates that the well should be 140 feet deep but our video indicates that the well is only 125 feet deep. The base of the well casing is starting to show signs of degradation at the casing bedrock interface, although no evidence of sediment production was observed during the pumping portion of the video. Some intervals of the well casing display a mineralized growth. This is interpreted as the same calcium that was encrusted on the submersible pump wire when we removed it from the well. a See below for still images from the video inspection.



Pump Maintenance

The pump is confirmed to be a Goulds 8 CRC with custom impellers and a 75 HP 575V Franklin motor. The pump intake and discharge were inspected and appeared to be in good condition. Both were observed to be free of defects and debris. The pump, motor and wire were cleaned using a high pressure washer. The column pipe was cleaned in a similar fashion with the addition of also cleaning the inside of the pipe with a lance attachment for the pressure washer. The external check valve was observed to be defective and warranting replacement. After pressure washing three lengths of column pipe were observed to be severely pitted and also warranted replacement. The bowl assembly of the pump was left intact as the pressures measured during testing indicated satisfactory performance.

Pump Installation

We reinstalled the existing pumping assembly with a new check valve and 3 lengths of new column pipe. The well was chlorinated to an initial concentration of 200 mg/L and circulated for one hour prior to installation of the permanent pump. The following day we returned to the site and operated the well to waste. The initial discharge was contained and neutralized before being directed to the appropriate area. Initial discharge had a chlorine concentration of >100 mg/L. The well was operated to waste for an additional period prior to sampling to clear any possible turbidity before samples were collected by water works staff. A pump installation report and copy of the chlorination record has been included with this report.

Conclusion & Recommendation

The ramp times for the VFD need to be adjusted as outlined earlier in the report. With the defective check valve and column pipe replaced this well should operate trouble free until its next regularly scheduled maintenance interval. At that time it would be beneficial to undertake some physical well rehabilitation. Ideally the well casing would be brushed from top to bottom and then the well vacuum airlifted to remove any accumulated debris out of the bottom of the well. Once the bottom of the well has been opened up (ideally to a depth of 140 feet where IWS had originally filled it in to) a period of surging and pumping with compressed air should be employed to restore any lost well capacity that may be experienced between the writing of this

report and the next service interval. This would also be a good opportunity to inspect the well casing for any corrosion hidden by mineral precipitates.

Respectfully

Dwayne Graff
President

Patrick Weed B. Comm.
Well Technician

TABLE 1

Well Initiatives Limited
Variable Rate Step Test

Municipality	Wellington North	***Well ID:***	**Mt Forest #5**
Town	Mt Forest	*Job No.:*	300043489
Location:	Sligo Road	*Date:*	7-Nov-18
Measuring Point (MP):	Top of water level tube	*MP Stickup:*	0.9 m above floor
Well Type:	Bedrock	*Well Diameter:*	300 mm
Well Depth:	42.7 m bmp	*Well Screen Size:*	N/A slot
Well Casing Bottom:	36.6 m bmp	*Well Screen Length:*	N/A m
Pump Type:	Submersible	*Pump Diameter:*	200 mm
Pump Model:	Goulds 8R CLC	*Motor Voltage:*	575 V
Pump Intake:	37.8 m bmp	*Motor phase:*	3
Static Water Level:	12.13 m bmp	*Motor HP:*	75

	Step 1			Step 2			Step 3		
	Rate (Usgpm)		238	*Rate (US gpm)*		476	*Rate (Usgpm)*		701
	Rate(L/s)		15.02	*Rate(L/s)*		30.03	*Rate(L/s)*		44.23
Elapsed Time (min)	Water Level (m bmp)	Drawdown (m)	Recovery (m)	Water Level (m bmp)	Drawdown (m)	Recovery (m)	Water Level (m bmp)	Drawdown (m)	Recovery (m)
0	12.13	0.00	15.63	12.19	0.06	21.53	12.30	0.17	
1	14.00	1.87	13.49	16.50	4.37	15.39	22.83	10.70	
2	14.54	2.41	13.09	18.60	6.47	14.61	24.55	12.42	
3	14.74	2.61	12.93	19.28	7.15	14.14	25.56	13.43	
4	14.89	2.76	12.76	19.59	7.46	13.78	26.22	14.09	
5	14.99	2.86	12.66	19.84	7.71	13.49	26.67	14.54	
6	15.15	3.02	12.58	20.10	7.97	13.28	27.04	14.91	
7	15.22	3.09	12.50	20.27	8.14	13.11	27.47	15.34	
8	15.28	3.15	12.45	20.42	8.29	12.98	27.69	15.56	
9	15.33	3.20	12.41	20.65	8.52	12.87	27.88	15.75	
10	15.37	3.24	12.38	20.75	8.62	12.78	28.04	15.91	
12	15.43	3.30	12.33	20.93	8.80	12.65	28.30	16.17	
15	15.50	3.37	12.28	21.11	8.98	12.52	28.58	16.45	
20	15.56	3.43	12.24	21.28	9.15	12.40	28.87	16.74	
25	15.60	3.47	12.21	21.45	9.32	12.33	29.09	16.96	
30	15.63	3.50	12.19	21.53	9.40	12.30	29.20	17.07	

Step Test Summary

Step	Pumping Rate (US gpm)	Pumping Rate (L/s)	Pumping Water Level (m bmp)	Drawdown (m)	Specific Capacity (L/sec/m)
1	238	15.02	15.63	3.50	4.29
2	476	30.03	21.53	9.40	3.19
3	701	44.23	29.20	17.07	2.59

Pump and Motor

Step	Pumping Rate (US gpm)	Pumping Rate (L/s)	Pressure (psi)	Current draw (amps)	Frequency (Hz)
1	238	15	16	R34.3, Y34.6, B32.6	30
2	476	30	42	R47.6, Y48.6, B46.8	45
3	701	44	64	R76.2, Y75.5, B75.5	60

Table 2: Video Log Summary

Client: Township of Wellingon North
Well ID: Mount Forest Well #5
Date: November 13, 2018
Static and Pumping Video.

Elapsed Time	Depth	Event/Notes
Chapter 1		
0:00	3′ 0″	3′ 0″ Below top of casing
3:08	38′ 11″	Static water level
7:23	119′ 11″	Install small submersible pump for video
32:13	119′ 11″	Stop tape – having pump troubles
Chapter 2		
0:00	119′ 11″	Start tape, pump on at 12 US gpm
3:21	119′ 11″	Stop tape to let picture clear
Chapter 3		
0:00	119′ 11″	Start tape, pumping at 12 US gpm
0:30	124′ 00″	Bottom of visible well
2:00	119′ 11″	Downhole view of casing/bedrock interface
10:52	71′ 00″	Stop tape to let picture clear.
Chapter 4		
0:00	71′ 00″	Start tape
2:00	59′ 02″	Shallowest view of well under pumping conditions
12:45	121′ 01″	Side scan of casing interface
13:28	124′ 00″	Bottom of visible well
18:30	111′ 04″	Side scan of casing
20:23	100′ 08″	Side scan of casing joint
24:50	81′ 09″	Side scan of casing joint
29:12	62′ 06″	Side scan of casing joint
32:30	58′ 10″	Pump off
39:08	45′ 06″	Side scan of casing joint
41:26	32′ 05″	Side scan of casing joint
43:44	6′ 00″	Casing joint
44:01	2′ 11″	Stop tape

Figure 1: Drawdown Chart
Mount Forest Well #5

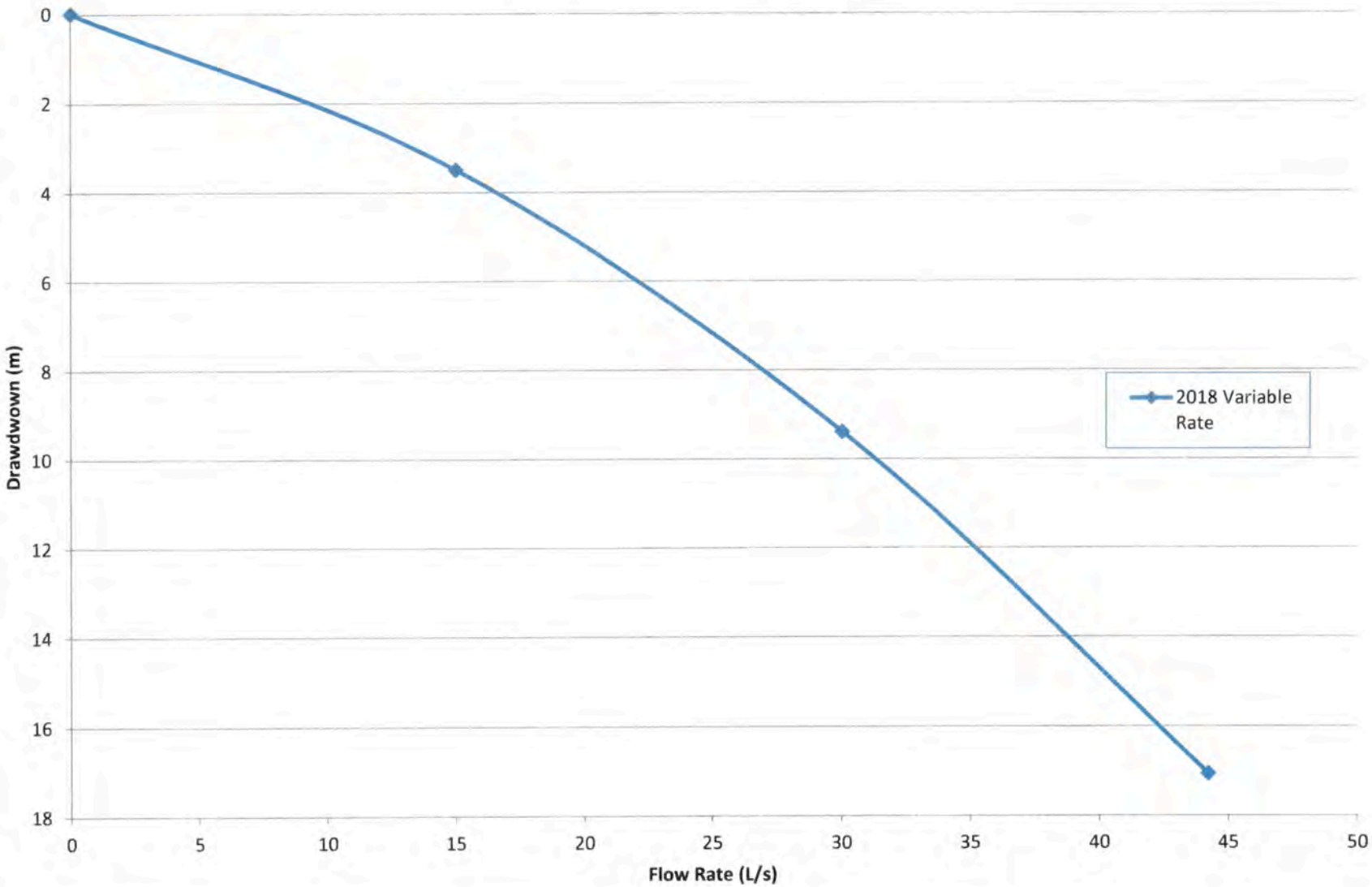
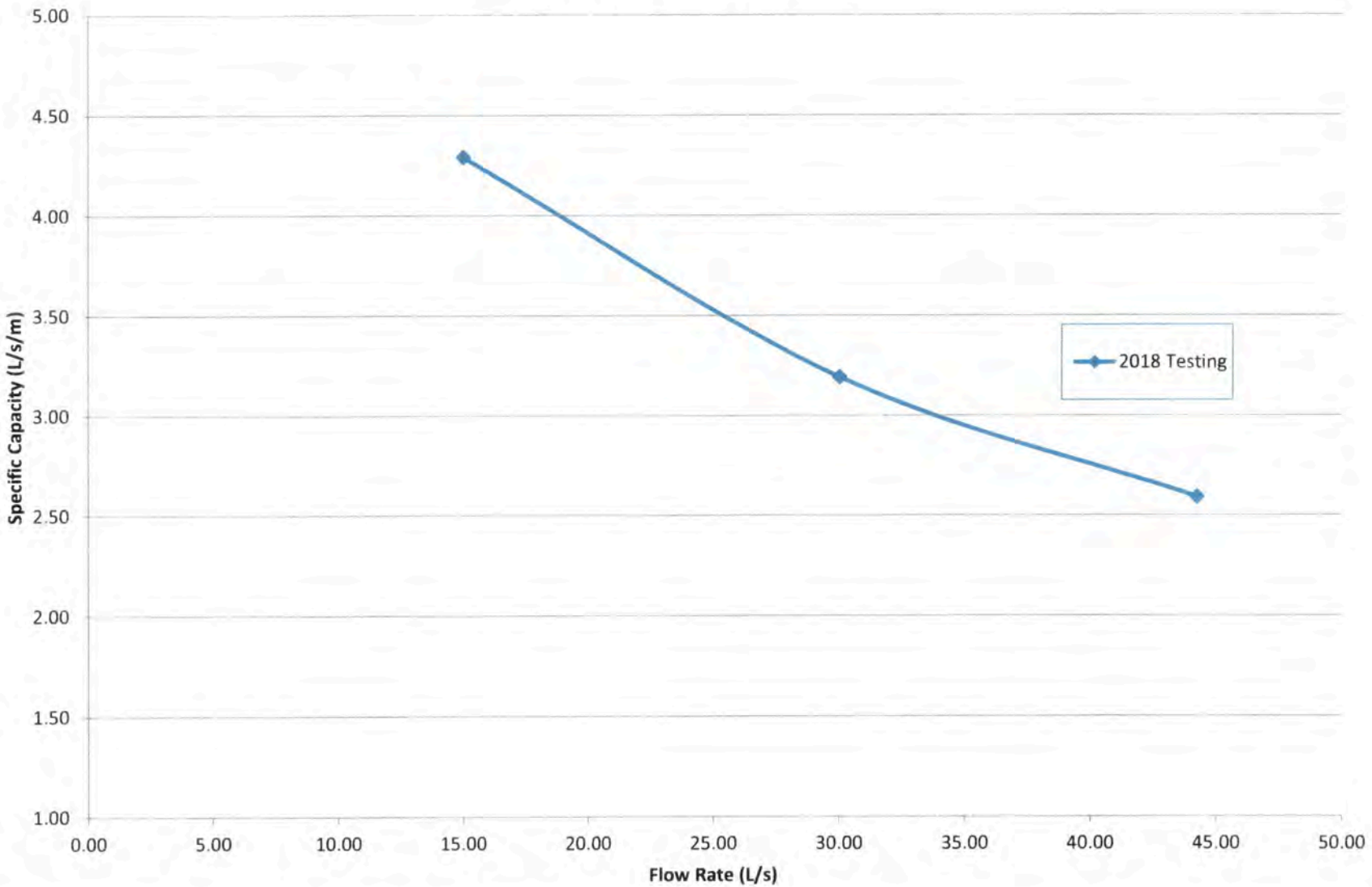


Figure 2: Specific Capacity
Mount Forest #5



Mount Forest #5

We are currently experiencing intermittent issues impacting registration and login including access to online learning. We apologize for any inconvenience

Public Health Ontario | Sante publique Ontario

ABOUT US BROWSE BY TOPIC SERVICES & TOOLS DATA & ANALYTICS LEARNING & DEVELOPMENT

Well disinfection tool

Disinfection is generally necessary when:

- a new well is installed
- the well or pump is serviced

This resource is intended for use by public health inspectors and well contractors. For additional information on well disinfection refer to chapter 8 of Water Supply Wells - Requirements and Best Management Practices from the Ministry of Environment and Climate Change.

Well

Units of measure

- Metric (cm/L/centimetres)
- Feet and inches

Type of Chlorine Disinfectant

- Bleach (solid or liquid)
- Granular calcium hypochlorite

Well diameter

12.00 inches

Desired concentration of chlorine

200 ppm (mg/L)

Well depth

125.00 feet

Concentration of disinfectant

47.00 %

Depth to water level

35.00 feet

Precautions

To disinfect the well add:
861.59 grams
of calcium hypochlorite

Other units of measure:
grams

Volume of water in the well:
2,002 litres

Dilution Ratio:
N/A

Clear

View Assumptions

- Important information about Disinfecting Wells
- Procedure for disinfecting a well
- Precautions when working with chlorine products
- Other resources

Contact

If you have any questions please contact us at eohswebhpb@oahpp.ca

Disclaimer

PUMP INSTALLATION RECORD

TECHNICIAN: DR, DG, PW.

DATE: 2018/11/27
Yyyy/mm/dd

CLIENT: Township of Wellington North
WELL I.D. /LOCATION: Mount Forest Well #5

PUMP INFORMATION

MAKE: Goulds
MODEL: 8RCRC
SERIAL NUMBER: 454775
BOWL DIA.:8"
NO. STAGES: 2
DISCHARGE DIA.: 6"
BOWL MAT'L: Cast Iron
IMP. MAT'L: Bronze
INTAKE B.B.P.: 122' (37.2m)

MOTOR INFORMATION

MAKE: Franklin
MODEL NO.: 2396136021
SERIAL NUMBER:01F1914-0018
DATE CODE:01F
MOTOR DIA.: 8"
HP: 75
VOLTS: 575
PHASE: 3
MAX. AMPS.: 86
S.F.: 1.15
KVA CODE: L
BASE OF MOTOR B.B.P: 126' (38.4m)

COLUMN PIPE INFORMATION

PIPE DIA.: 6"
THREAD TYPE: 8V
WALL THICKNESS: Schd 40
PIPE MAT'L: Steel
TOTAL PIPE (FT): 119' (36.2m)
CHECK VALVE: external @ 33.2 m

WIRE INFORMATION

WIRE SIZE: 6 AWG
WIRE TYPE: SOW
TOTAL LENGTH: 126' (38.4m)

WELL INFORMATION

WELL DEPTH: 140' (video shows 125 ' from GS)
WELL DIA.: 12"
CONSTRUCTION: Bedrock
STATIC W.L.: 44.5 ' (13.5 m)

NOTES: 50 feet of column pipe replaced at time of reinstall.
1" PVC water level tube total length 110'
New external check valve installed.

Well Initiatives Limited 7461 County Road 18, P.O. Box 416 Elora ON N0B 1S0 CANADA
telephone (519) 846-8289 **fax** (519) 846-8281 **web** info@wellinitiatives.com

WELL INITIATIVES

December 20, 2018

Via: Email

Mr. Corey Schmidt
Township of Wellington North
Water & Sewer Department
P.O. Box 215, 7490 Sideroad 7 West
Kenilworth ON N0G 2E0

Dear Mr. Schmidt:

Re: Mount Forest #5
Project No.: 300043489.0000

Introduction

Well Initiatives Limited (WIL) was awarded and completed a well maintenance program for Mount Forest #5. This report documents the work completed on the well during the period of November 7 to 28, 2018.

Background

The well was originally constructed as a 300 mm (12" diameter) bedrock well with an original finished depth of 122 m (400') in 1968 by International Water Systems (IWS). This well is one of the supply wells for the town of Mount Forest water system. The lower portion of the well was abandoned and filled to a depth of 42.7 m (140') in 2002 by IWS due to the lower portion of the well being unproductive.

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We mobilized to the site on November 7 and conducted a variable rate test using the clients pumping assembly. The water for the test was directed through the flow to waste and then into the catch basin located in front of the pump house. Flow rates were measured using a WIL supplied calibrated digital flowmeter placed in line between the flow to waste and the catch basin. Flow rates used were 15, 30 and 45 L/s. The well was operated at each flow rate for 30 minutes followed by 30 minutes of recovery with water levels taken at regular intervals. On the same day the pumping assembly was removed from the well. A copy of the pumping data has been included as Table 1. This data has also been plotted and included as Figure 1 and 2.

We returned on November 13 and performed a static and pumping video inspection of the well. The column pipe and pumping assembly were also pressure washed on this day. A copy of this video and video summary has been included as Table 2.

On November 27 the well was chlorinated to an initial concentration of 200 mg/L using 47% granular sodium hypochlorite mixed into a solution. After the solution was added to the well the well was circulated with a small submersible for a period of 1 hour before the permanent pump was reinstalled. On November 28 the well was operated to waste. The initial discharge was contained in WIL's 9,000 settling tank and neutralized before being discharged to the natural environment. Initial discharge had a chlorine concentration of >100 mg/L. Samples were collected and submitted by the county for bacteriological analysis.

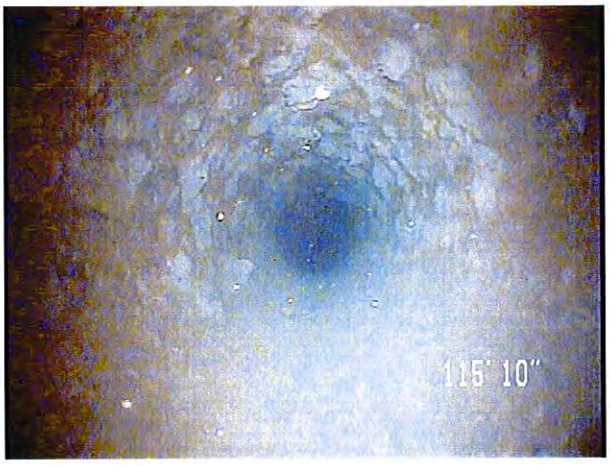
Testing Results

When this well was new it had a reported specific capacity of 3.26 L/s/m at a flow rate of 25.2 L/s. There was no well performance data available from the well reconstruction completed in 2002, which would have lowered the specific capacity when the bottom of the well was filled in. Data from the testing indicates that the specific capacity is currently 3.19 L/s/m at a flow rate of 30.5 L/s. When the well was operated at 45 L/s the specific capacity was observed to be 2.59 L/s/m. The pump was operated in VFD mode for the duration of the testing. At the high rate the pump performance was close to the factory curve. Current draw measured during pumping also indicates that the motor is operating at or close to factory specifications. No well rehabilitation was warranted at this time since the well is currently operating very close to its as constructed efficiency.

During the testing we noted the VFD ramp time was operating outside the motor manufactures specifications. The motor requires that the motor speed be set to be operating at 30 Hz in one second. We observed the motor ramp times taking approximately 7 seconds to reach 30 Hz. Operating the motor with slow ramp times will shorten the life of the motor due to improper lubrication of the internal bearings in the motor.

Video Inspection

A static and pumping video inspection of the well was completed. The reference point for the video inspection was the surface of the pump house floor. The video inspection revealed that the bottom of the visible well is less than the overall depth reported in 2002 when the lower portion of the well was filled in. The well record completed by IWS indicates that the well should be 140 feet deep, but our video indicates that the well is only 125 feet deep. The base of the well casing is starting to show signs of degradation at the casing bedrock interface, although no evidence of sediment production was observed during the pumping portion of the video. Some intervals of the well casing display a mineralized growth. This is interpreted as the same calcium that was encrusted on the submersible pump wire when we removed it from the well. a See below for still images from the video inspection.



Pump Maintenance

The pump is confirmed to be a Goulds 8 CRC with custom impellers and a 75 HP 575V Franklin motor. The pump intake and discharge were inspected and appeared to be in good condition. Both were observed to be free of defects and debris. The pump, motor and wire were cleaned using a high pressure washer. The column pipe was cleaned in a similar fashion with the addition of also cleaning the inside of the pipe with a lance attachment for the pressure washer. The external check valve was observed to be defective and warranting replacement. After pressure washing three lengths of column pipe were observed to be severely pitted and also warranted replacement. The bowl assembly of the pump was left intact as the pressures measured during testing indicated satisfactory performance.

Pump Installation

We reinstalled the existing pumping assembly with a new check valve and 3 lengths of new column pipe. The well was chlorinated to an initial concentration of 200 mg/L and circulated for one hour prior to installation of the permanent pump. The following day we returned to the site and operated the well to waste. The initial discharge was contained and neutralized before being directed to the appropriate area. Initial discharge had a chlorine concentration of >100 mg/L. The well was operated to waste for an additional period prior to sampling to clear any possible turbidity before samples were collected by water works staff. A pump installation report and copy of the chlorination record has been included with this report.

Conclusion & Recommendation

The ramp times for the VFD need to be adjusted as outlined earlier in the report. With the defective check valve and column pipe replaced this well should operate trouble free until its next regularly scheduled maintenance interval. At that time it would be beneficial to undertake some physical well rehabilitation. Ideally the well casing would be brushed from top to bottom and then the well vacuum airlifted to remove any accumulated debris out of the bottom of the well. Once the bottom of the well has been opened up (ideally to a depth of 140 feet where IWS had originally filled it in to) a period of surging and pumping with compressed air should be employed to restore any lost well capacity that may be experienced between the writing of this report and the next service interval. This would also be a good opportunity to inspect the well casing for any corrosion hidden by mineral precipitates.

Yours truly,

Well Initiatives Limited

Dwayne Graff
President
DG/PW:sd

Patrick Weed B. Comm.
Well Technician

Enclosure(s) Installation Report
Tables and Figures
Chlorination Record

WELL INITIATIVES

Installation Record

PUMP INSTALLATION RECORD

TECHNICIAN: DR, DG, PW.

DATE: 2018/11/27
Yyyy/mm/dd

CLIENT: Township of Wellington North
WELL I.D. /LOCATION: Mount Forest Well #5

PUMP INFORMATION

MAKE: Goulds
MODEL: 8RCRC
SERIAL NUMBER: 454775
BOWL DIA.:8"
NO. STAGES: 2
DISCHARGE DIA.: 6"
BOWL MAT'L: Cast Iron
IMP. MAT'L: Bronze
INTAKE B.B.P.: 122' (37.2m)

MOTOR INFORMATION

MAKE: Franklin
MODEL NO.: 2396136021
SERIAL NUMBER:01F1914-0018
DATE CODE:01F
MOTOR DIA.: 8"
HP: 75
VOLTS: 575
PHASE: 3
MAX. AMPS.: 86
S.F.: 1.15
KVA CODE: L
BASE OF MOTOR B.B.P: 126' (38.4m)

COLUMN PIPE INFORMATION

PIPE DIA.: 6"
THREAD TYPE: 8V
WALL THICKNESS: Schd 40
PIPE MAT'L: Steel
TOTAL PIPE (FT): 119' (36.2m)
CHECK VALVE: external @ 33.2 m

WIRE INFORMATION

WIRE SIZE: 6 AWG
WIRE TYPE: SOW
TOTAL LENGTH: 126' (38.4m)

WELL INFORMATION

WELL DEPTH: 140' (video shows 125 ' from GS)
WELL DIA.: 12"
CONSTRUCTION: Bedrock
STATIC W.L.: 44.5 ' (13.5 m)

NOTES: 50 feet of column pipe replaced at time of reinstall.
1" PVC water level tube total length 110'
New external check valve installed.

WELL INITIATIVES

Tables and Figures

TABLE 1

Well Initiatives Limited
Variable Rate Step Test

Municipality	Wellington North	***Well ID:***	**Mt Forest #5**
Town	Mt Forest	*Job No.:*	300043489
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Well Depth:	42.7 m bmp	*Well Screen Size:*	N/A slot
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Pump Type:	Submersible	*Pump Diameter:*	200 mm
Pump Model:	Goulds 8R CLC	*Motor Voltage:*	575 V
Pump Intake:	37.8 m bmp	*Motor phase:*	3
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	Step 1			Step 2			Step 3		
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4	14.89	2.76	12.76	19.59	7.46	13.78	26.22	14.09	
5	14.99	2.86	12.66	19.84	7.71	13.49	26.67	14.54	
6	15.15	3.02	12.58	20.10	7.97	13.28	27.04	14.91	
7	15.22	3.09	12.50	20.27	8.14	13.11	27.47	15.34	
8	15.28	3.15	12.45	20.42	8.29	12.98	27.69	15.56	
9	15.33	3.20	12.41	20.65	8.52	12.87	27.88	15.75	
10	15.37	3.24	12.38	20.75	8.62	12.78	28.04	15.91	
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Step Test Summary

Step	Pumping Rate (US gpm)	Pumping Rate (L/s)	Pumping Water Level (m bmp)	Drawdown (m)	Specific Capacity (L/sec/m)
1	238	15.02	15.63	3.50	4.29
2	476	30.03	21.53	9.40	3.19
3	701	44.23	29.20	17.07	2.59

Pump and Motor

Step	Pumping Rate (US gpm)	Pumping Rate (L/s)	Pressure (psi)	Current draw (amps)	Frequency (Hz)
1	238	15	16	R34.3, Y34.6, B32.6	30
2	476	30	42	R47.6, Y48.6, B46.8	45
3	701	44	64	R76.2, Y75.5, B75.5	60

Table 2: Video Log Summary

Client: Township of Wellingon North
Well ID: Mount Forest Well #5
Date: November 13, 2018
Static and Pumping Video.

Elapsed Time	Depth	Event/Notes
Chapter 1		
0:00	3' 0"	3' 0" Below top of casing
3:08	38' 11"	Static water level
7:23	119' 11"	Install small submersible pump for video
32:13	119' 11"	Stop tape – having pump troubles
Chapter 2		
0:00	119' 11"	Start tape, pump on at 12 US gpm
3:21	119' 11"	Stop tape to let picture clear
Chapter 3		
0:00	119' 11"	Start tape, pumping at 12 US gpm
0:30	124' 00"	Bottom of visible well
2:00	119' 11"	Downhole view of casing/bedrock interface
10:52	71' 00"	Stop tape to let picture clear.
Chapter 4		
0:00	71' 00"	Start tape
2:00	59' 02"	Shallowest view of well under pumping conditions
12:45	121' 01"	Side scan of casing interface
13:28	124' 00"	Bottom of visible well
18:30	111' 04"	Side scan of casing
20:23	100' 08"	Side scan of casing joint
24:50	81' 09"	Side scan of casing joint
29:12	62' 06"	Side scan of casing joint
32:30	58' 10"	Pump off
39:08	45' 06"	Side scan of casing joint
41:26	32' 05"	Side scan of casing joint
43:44	6' 00"	Casing joint
44:01	2' 11"	Stop tape

Figure 1: Drawdown Chart
Mount Forest Well #5

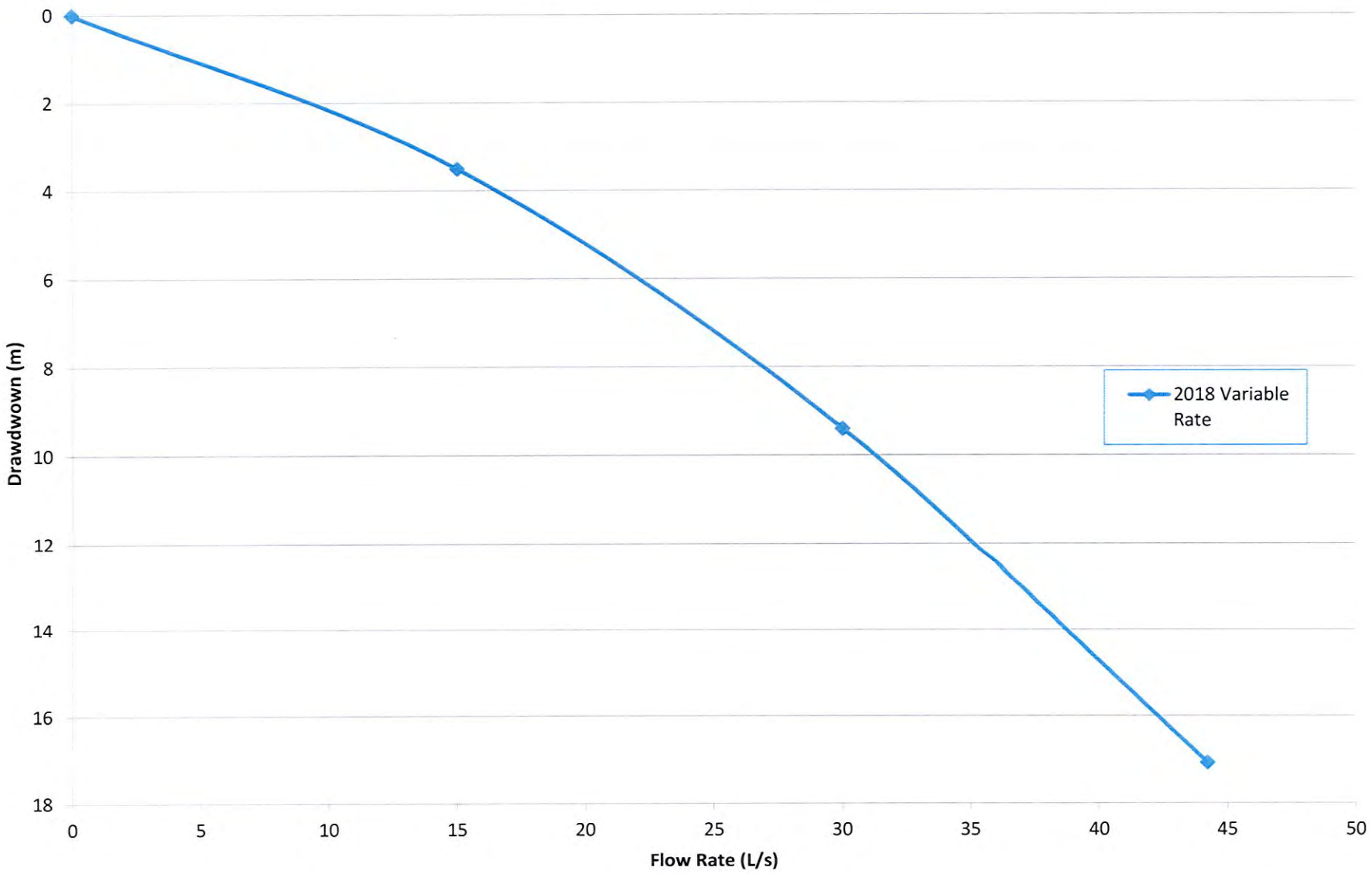
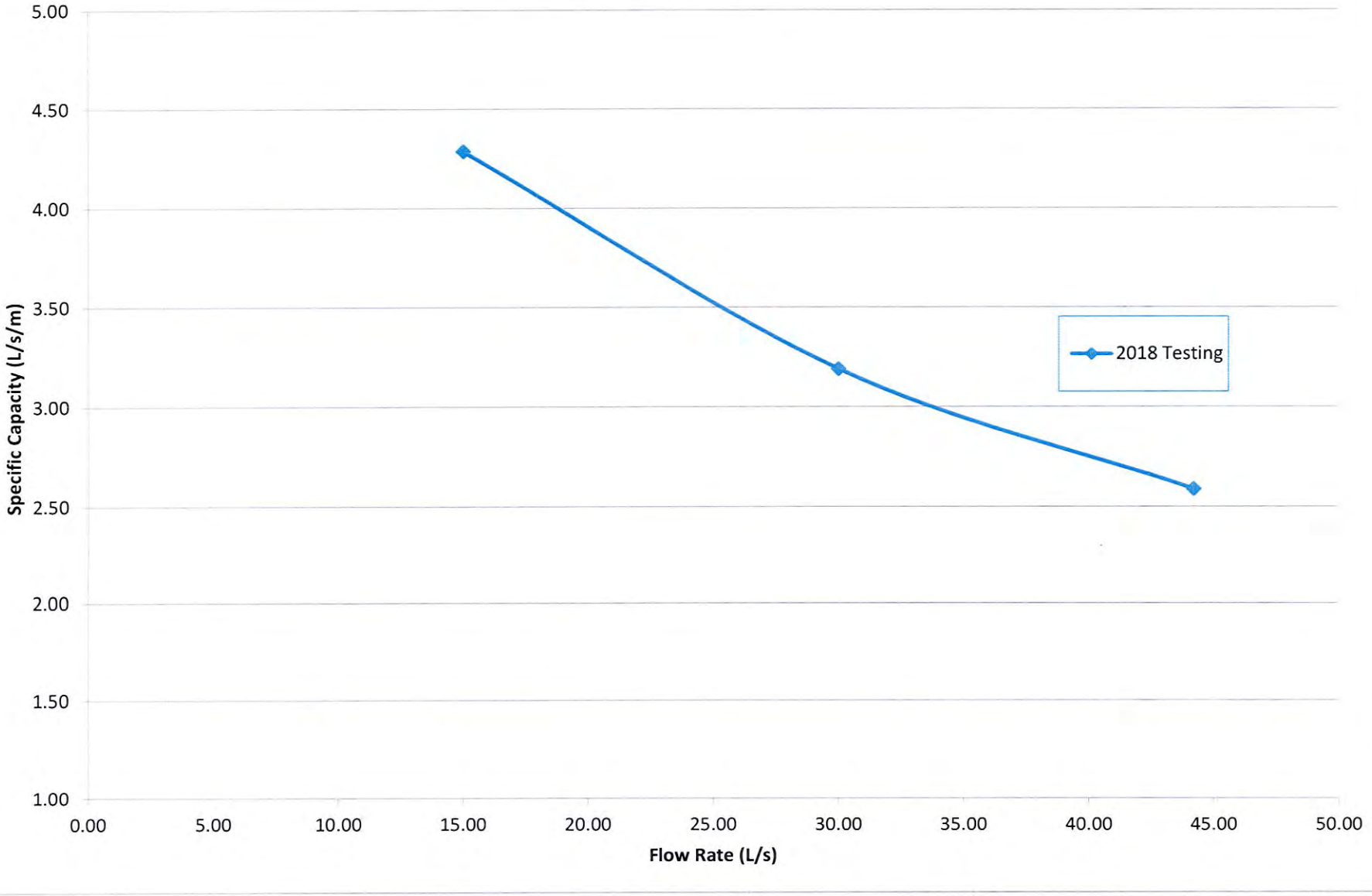


Figure 2: Specific Capacity
Mount Forest #5



WELL INITIATIVES

Chlorination Record

Mount Forest #5

We are currently experiencing intermittent issues impacting registration and login including access to online learning. We apologize for any inconvenience.

Public Health Ontario | Santé publique Ontario

ABOUT US BROWSE BY TOPIC SERVICES & TOOLS DATA & ANALYTICS LEARNING & DEVELOPMENT

INDEX A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Well disinfection tool

Disinfection is generally necessary when:

- a new well is installed
- the well or pump is serviced

This resource is intended for use by public health inspectors and well contractors. For additional information on well disinfection refer to chapter 8 of Water Supply Wells – Requirements and Best Management Practices from the Ministry of Environment and Climate Change.

Well

Units of measure

- ○ Metres and Centimetres
- ◉ Feet and Inches

Well diameter

12.00 inches

Well depth

125.00 feet

Depth to water level

35.00 feet

Type of Chlorine Disinfectant

- ○ Bleach solution
- ◉ Granular calcium hypochlorite

Desired concentration of chlorine

200 ppm or mg/L

Concentration of disinfectant

47.00 %

Precautions

To disinfect the well add:
861.59 grams
of calcium hypochlorite.

Other units of measure:
grams

Volume of water in the well:
2,002 litres

Dilution Ratio:
N/A

Clear

View Assumptions

- Important Information about Disinfecting Wells
- Procedure for disinfecting a well
- Precautions when working with chlorine products
- Other resources

Contact

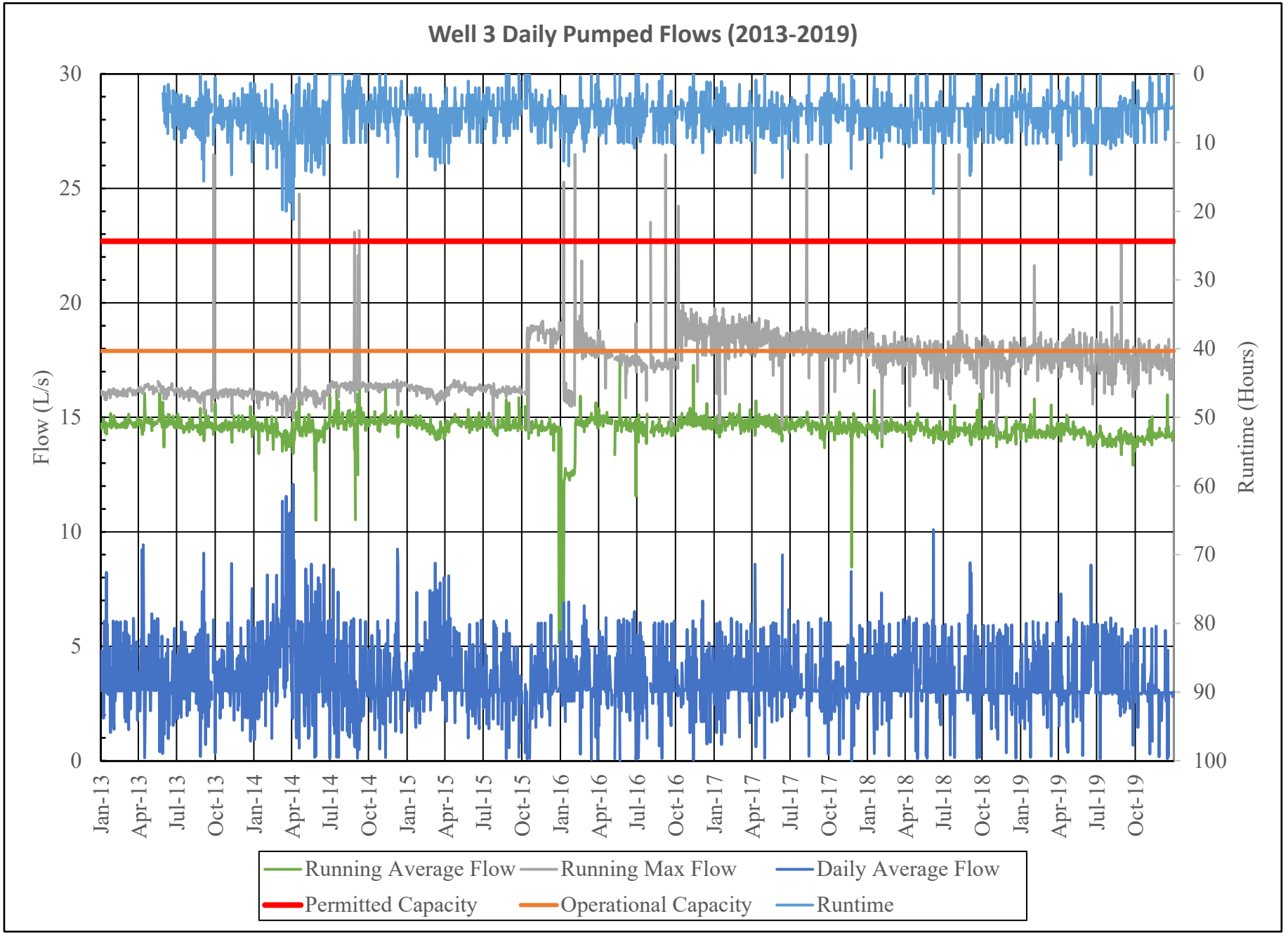
If you have any questions please contact us at eoh@oahpp.ca

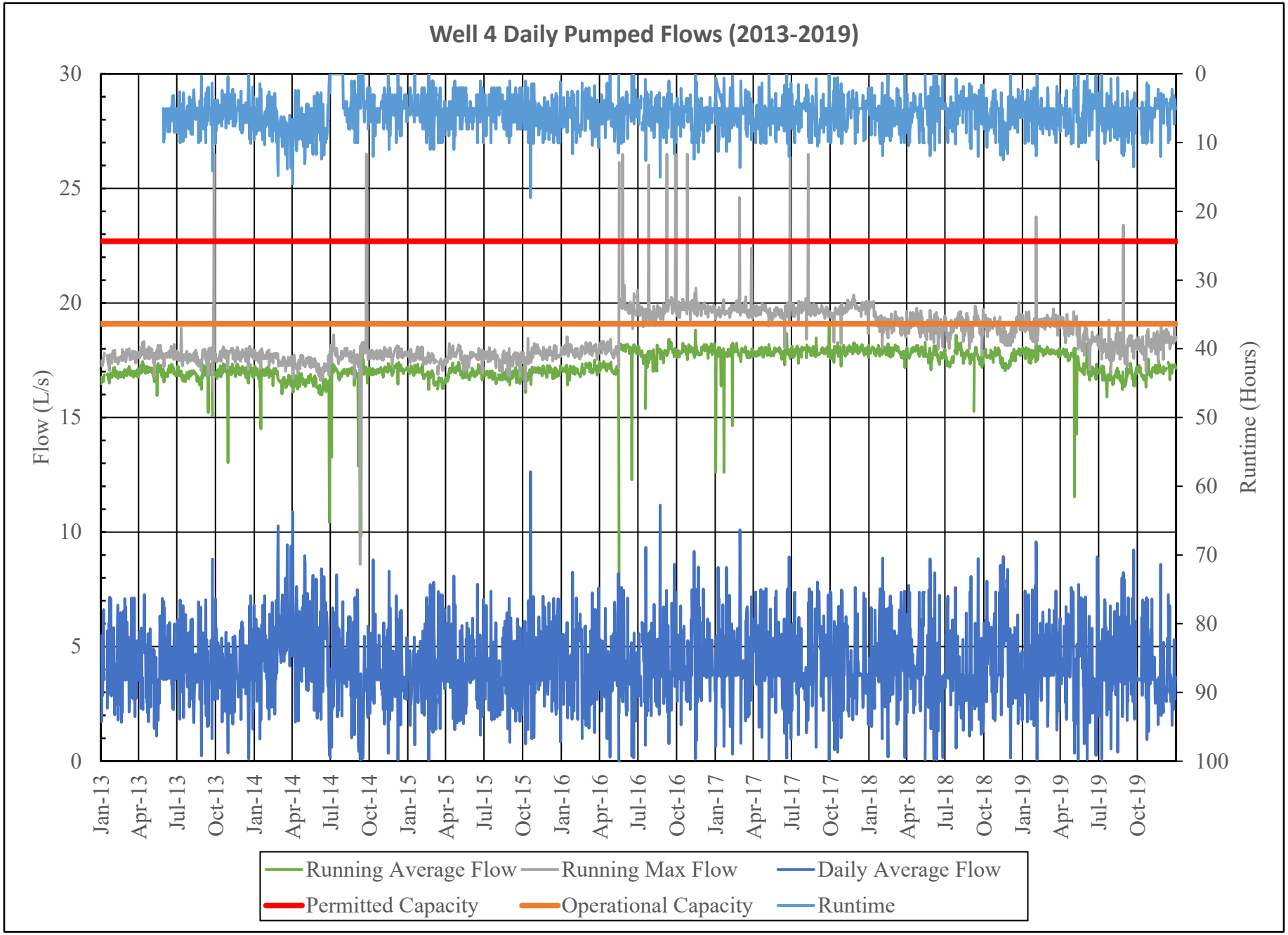
Disclaimer

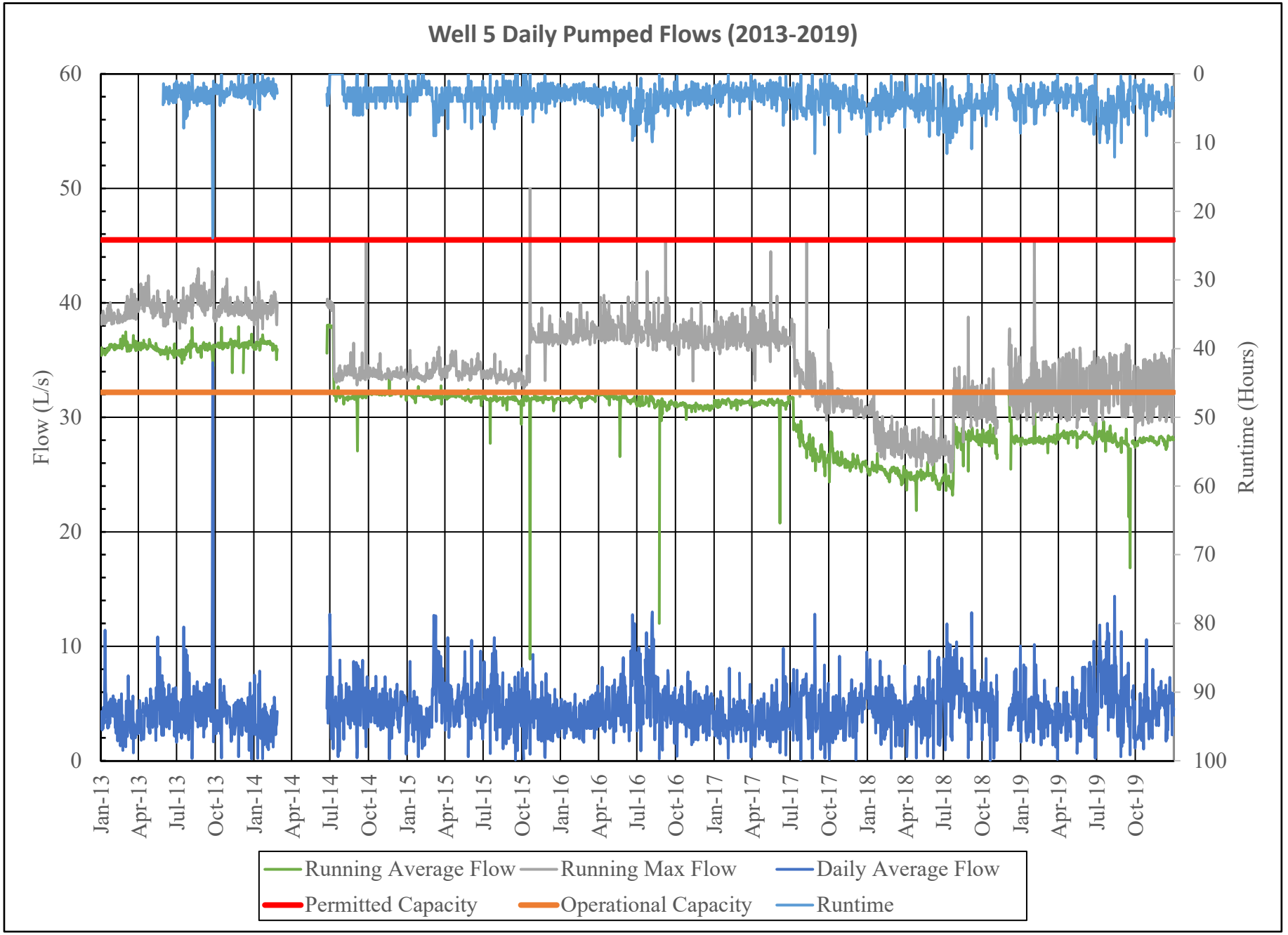
APPENDIX C
WELL PUMPAGE SUMMARIES

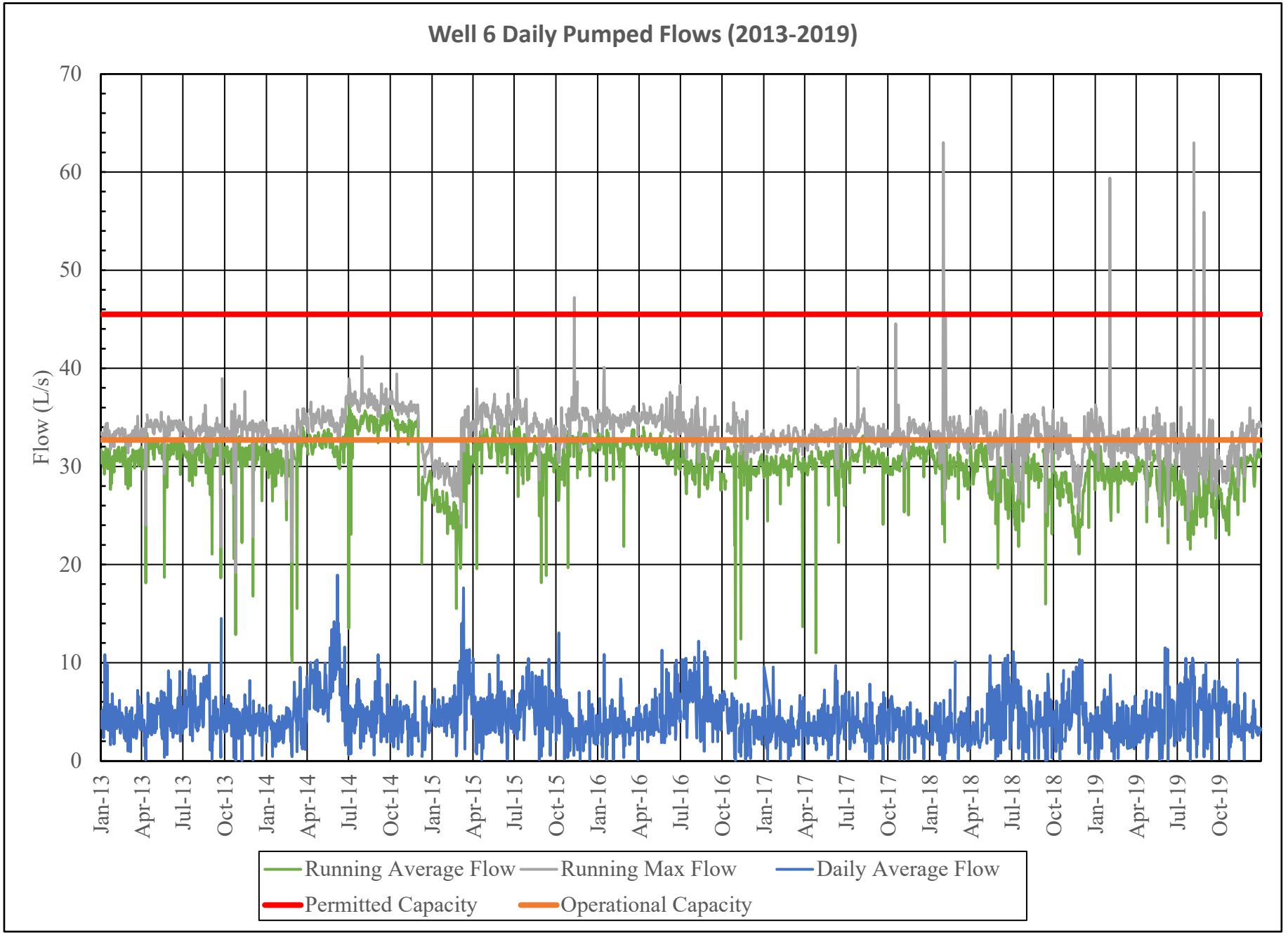
Mount Forest Well Supply
Average Operational Pumping Rates (L/s)

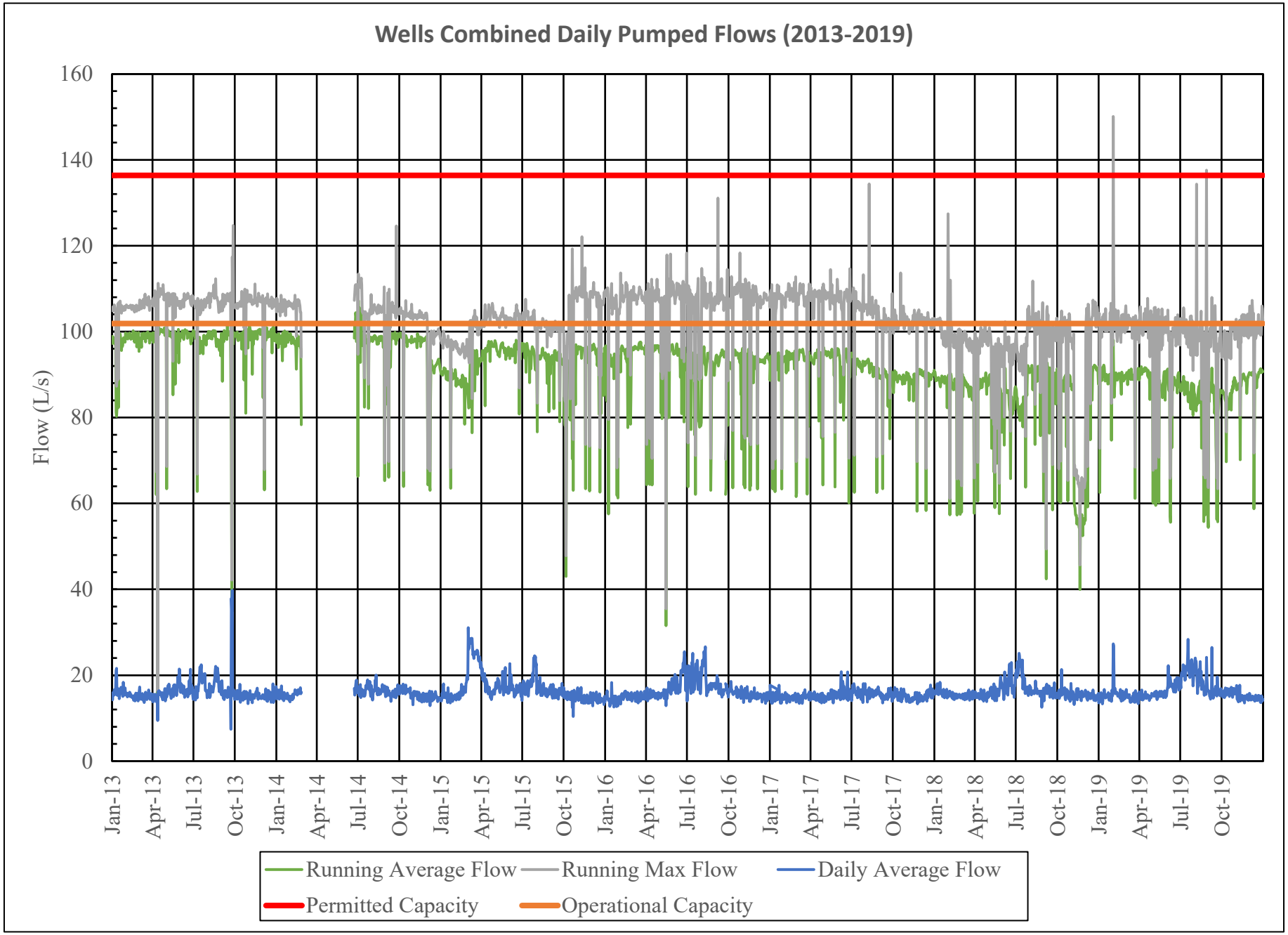
Year	Well 3	Well 4	Well 5	Well 6	Total	Firm
2013	16.1	17.7	39.6	33.5	106.9	67.4
2014	16.2	17.6	35.6	34.9	104.3	68.7
2015	16.7	17.7	34.5	33.7	102.6	68.1
2016	17.9	19.2	37.5	34.0	108.6	71.2
2017	18.3	19.7	34.9	33.1	106.1	71.2
2018	17.7	19.0	29.3	32.9	98.9	69.6
2019	17.6	18.6	32.4	32.2	100.8	68.4
2013-2019	17.2	18.5	34.8	33.5	104.0	69.2
			In cubic metres per day:		8,988	5,980
2017-2019	17.9	19.1	32.2	32.7	101.9	69.2
			In cubic metres per day:		8,806	5,976


Well 3 Daily Pumped Flows (2013-2019)
Flow (L/s)
Runtime (Hours)
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Running Average Flow
Running Max Flow
Daily Average Flow
Permitted Capacity
Operational Capacity
Runtime


Well 4 Daily Pumped Flows (2013-2019)
Flow (L/s)
Runtime (Hours)
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Running Average Flow
Running Max Flow
Daily Average Flow
Permitted Capacity
Operational Capacity
Runtime


Well 5 Daily Pumped Flows (2013-2019)
Flow (L/s)
Runtime (Hours)
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Running Average Flow
Running Max Flow
Daily Average Flow
Permitted Capacity
Operational Capacity
Runtime


Well 6 Daily Pumped Flows (2013-2019)
Flow (L/s)
70
60
50
40
30
20
10
0
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Running Average Flow
Running Max Flow
Daily Average Flow
Permitted Capacity
Operational Capacity


Wells Combined Daily Pumped Flows (2013-2019)
Flow (L/s)
160
140
120
100
80
60
40
20
0
Jan-13
Apr-13
Jul-13
Oct-13
Jan-14
Apr-14
Jul-14
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Jul-16
Oct-16
Jan-17
Apr-17
Jul-17
Oct-17
Jan-18
Apr-18
Jul-18
Oct-18
Jan-19
Apr-19
Jul-19
Oct-19
Running Average Flow
Running Max Flow
Daily Average Flow
Permitted Capacity
Operational Capacity

APPENDIX D
COMPARISON OF ELEVATED TANK VARIETIES

HIGH LEVEL COMPARISON OF DIFFERENT VARIETIES OF COMPOSITE ELEVATED WATER STORAGE TANKS (concrete pedestal) - PRELIMINARY

N.R. Not required N.A. Not applicable CET - composite elevated tank GF-BET = glass-fused bolted elevated tank

	Welded carbon steel composite elevated tank	Glass-fused bolted steel composite elevated tank	Welded SS composite elevated tank	Welded SS dual-zone composite elevated tank
Typical range of tank sizes when used				
Common applications	Conventional	If want to minimize need for maintenance in comparison to a carbon steel coated tank.	If want to minimize need for maintenance in comparison to a carbon steel coated tank.	Typically for operational reasons such as: 1. If large seasonal differences in demand, or if build for future much larger demand, such that operate using just one chamber at a time (for water turnover - e.g. water quality; winter freezing issues). 2. If the water tank absolutely cannot be taken out of service.
General description	Coated welded steel	Glass-fused finish. Bolted and not welded.	SS instead of carbon steel	Inner tank compartment and outer tank compartment. SS fabrication due to difficulty recoating interior from humidity/condensation caused by active chamber.
Advantages	Above base size in the order of 2,000m3 has lowest capital cost of elevated tanks.	Glass-fused finish reduces routine maintenance efforts and costs. Competitive capital cost for smaller size elevated tanks. Requires larger pedestal which can drive up costs on larger volume tanks.	No need to recoat (the interior)	No need to recoat (the interior). No need to take tank completely out of service (exterior chamber can be taken out of service to recoat exterior).
Disadvantages	Recoating costs every 20 years (e.g. greater than GF-BET)	Resealing costs every 10-20 years. Tank life span may be less than a CET. Might be considered less aesthetically appealing.	Higher capital cost due to use of SS. Exterior aesthetics of SS finish (e.g. grinding marks at welds & discoloration due to inconsistencies in SS usually drives either an exterior coating or insulation and cladding)	Significantly higher capital cost due to use of SS and fabrication of two separate chambers. Exterior aesthetics of SS finish (e.g. grinding marks at welds & discoloration due to inconsistencies in SS usually drives either an exterior coating or insulation and cladding)
Exterior coating	Touch ups/reseal every 20 years; Sandblast and complete recoat every 40 years	touch up sealant application at bolts every 20 years	For aesthetic reasons, would likely want to coat the exterior or else clad it. Touch ups/reseal every 20 years; Sandblast and recoat every 40years	For aesthetic reasons, would likely want to coat the exterior or else clad it. Touch ups/reseal every 20 years; Sandblast and recoat every 40years
Interior coating	Touch ups/reseal every 20 years; Sandblast and complete recoat every 40 years	touch up sealant application at bolts every 20 years, possibly replace select panels every 40 years.	Exterior coating touch ups/reseal every 20 years; Sandblast and complete recoat exterior every 40 years (no exterior recoating if it is insulated and cladded)	Exterior coating touch ups/reseal every 20 years; Sandblast and complete recoat exterior every 40 years (no exterior recoating if it is insulated and cladded)
Exterior cladding (can insulate) 50-year life (?)	N.A.	Optional and recommended if tank will have low turnover	Optional (typical) if not applying an exterior coating	Optional (typical) if not applying an exterior coating
Typical maintenance downtime	6-8 weeks when recoating	1-2 weeks when resealing	3-4 weeks when recoating (the exterior)	One compartment always active, 3-4 weeks when recoating the exterior (exterior compartment out of service)
Comparative cost				Significantly higher cost. Probable 40-50 year payback in comparison to a standard CET
Lifespan	80-100 years	40-50 years	80-100 years	80-100 years

Notes:
1. Above based on a June 26, 2020, discussion with an elevated storage contractor.
2. Most CETs don't get cathodic protection. Coating system typically considered sufficient.
3. Hamilton has a small dual-zone composite elevated tank used as a surge tank. 26 years old.
4. Above types of tanks are the only ones considered in this comparison summary.
5. Other tank suppliers would suggest the GF-BET tank has an 80-100 year lifespan.

APPENDIX E

OPINION OF PROBABLE COSTS

Township of Wellington North CET = Composite Elevated Tank June 26, 2020

New Mount Forest Elevated Water Tank

High Level Life Cycle Cost Comparison

PRELIMINARY

Service Year	Year	Major service performed	E.T. Alternative #1 Ex. Grant Street site 4,420m3 Demolish standpipe	E.T. Alternative #2 Greenfield 2,420m3 Maintain Standpipe See Note 2	E.T. Alternative #3 Greenfield 4,420m3 Demolish standpipe
0	2020	New CET constructed	$5,500,000	$3,400,000	$4,500,000
		Standpipe repairs and recoating (See Note 5)	N/A	$825,000	N/A
		New watermain: Industrial Drive extenstion to Coral Lea		$100,000	$100,000
		New watermain: Coral Lea Drive, Industrial Dr to Alternative No. 2 E.T. Site		$237,000	*
		New watermain: Coral Lea Drive, Alternative No. 2 E.T. site to Hwy #6		$306,000	*
		New watermain: Hwy #6, Coral Lea Drive to existing main		$48,000	*
		New watermain: Coral Lea Drive, Industrial Dr. to Perth St			$147,000
		New watermain: Perth St, Coral Lea Dr. to existing main			$127,000
		Watermain: Replace old C.I. Grant Street main	$102,000	$102,000	
		Total initial capital cost	$5,602,000	$5,018,000	$4,874,000
20	2040	CET touch-up and overcoat	$347,623	$203,757	$311,748
		Standpipe touch-up and overcoat (see Note 4)		$235,939	
40	2060	CET coating removal and replacement	$989,319	$605,660	$926,660
		Standpipe coating removal and replacement		$734,808	
60	2080	CET touch-up and overcoat	$309,620	$181,482	$277,667
65	2085	Standpipe replacement		$1,200,000	
80	2100	CET coating removal and replacement	$881,163	$539,447	$825,354
85	2105	Standpipe touch-up and overcoat (see Note 4)		$195,477	
100	Assumed end of new CET service life				
PRESENT VALUE TO END SERVICE YEAR 100			$8,129,725	$8,914,570	$7,215,429
PRESENT VALUE TO END SERVICE YEAR 64			$7,248,562	$6,979,646	$6,390,075

Some of the watermain for Alternative No. 2 is required to service new industrial land and could be discounted from the above analysis

*Watermain connection to Hwy #6 via. Coral Lea Drive would improve performance of this alternative, and as per Alternative No. 2, it would be required to service new industrial lands.

See notes on next page

Notes

1. CET life cycle costing based on information provided by Landmark.
2. Standpipe was built in 1985. If it lasts 100 years it will need to be replaced by 2085.
3. Above is only a high level comparison of the life cycle costs of the major services that will need to be performed on the elevated storage. As such, the life cycle maintenance costs are not all inclusive (e.g. 5-year visual & ROV inspection; powerwashing every 10 years; drain and & clean every 10 years). This comparison is solely intended for assisting with the evaluation and future selection of the preferred alternative.
4. Based on Landmark information, assuming $9.30/sq.m (combined exterior/interior price) + $19,260 temporary facilities/setup for exterior work + $23,500 for interior repair work. Therefore, assume $250,000 present value for purposes of this life cycle analysis. Using Landmark's interest and inflation values to be consistent.
5. Initial cost for Standpipe repairs and recoating based on a 2019 Contractor inspection and contractor pricing information for assumed items including the method that would be selected for recoating. The Township will need to decide and the total cost may be higher.
6. Gross assumption for capital cost to replace the existing standpipe

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST WATER WORKS
NEW 4,420 m^3 COMPOSITE ELEVATED TANK AT EXISTING POOL/STANDPIPE SITE
(Year 2020 Prices)

PRELIMINARY COST ESTIMATE

4420 m3 elevated steel tank and concrete pedestal - base price as per Landmark June 25/20 quote	$3,300,000
Premium cost due to existing site constraints (as per Landmark June 25/20 email) - See below Note 5	$1,000,000
Site work - allowance	$35,000
Electrical & controls - allowance	$25,000
Allowance for mech inside base of E.T. - assume included in base price	$0
Allowance for control room constructed within pedestal - not required	$0
logos or striping	$20,000
allowance for flow paced chlorine equipment/controls + residual analyser + flow meter	$0
allowance for cathodic protection - appears to be included	$0
Reprogramming SCADA	$5,000
Upgrade/replace well pumps and motor starters for 5m higher operating head - excluded; see Note 7	$0
Tank mixing system - if required	$25,000
Demolish existing standpipe (assumes keep existing BPS building/mechanical - just disconnect)	$125,000
Subtotal construction	$4,535,000
Contingency (10%)	$453,500
TOTAL construction	**$4,988,500**
Engineering (Schedule B Class EA work)	$25,000
Geotechnical investigation	$7,500
Engineering (assumed to be 8% of construction cost)	$399,100
TOTAL engineering	**$431,600**
Subtotal (Construction + Engineering)	$5,420,100
Net HST (1.76%)	$95,394
TOTAL (Construction + Engineering)	**$5,515,494**
MECP ECA Application fee	$2,200
TOTAL	**$5,517,694**

Say Total of **$5,500,000**

Cost per cubic metre of storage **$1,244**

NOTES:

1. The above **excludes** the following, where applicable

- off-site watermain, including connection to existing system	Site work allowance includes this
- hydro line extension to service the site	Not applicable
- off-site drainage/overflow works	Already exists
- access to site	Already exists
- cost of property	Not applicable
- control room in pedestal c/w heating & lighting	Not applicable
- containment for coatings operations, if applicable	Assumed to be included in $1M premium budget
- extra foundation costs if soil bearing capacity < 200 Kpa	Assume not applicable
- extra cost for special coating system, if desired/selected	Assume not applicable
- property purchase/property matters	Not applicable

2. Above based on a tank with a H.W.L. of 117 ft. (35.7 m), calc. elev. 464.45 — 3m higher than the existing standpipe
3. Add/subtract $5,000 allowance per m of height of elevated tank — Not applicable
4. **A significant price component of elevated storage tanks is steel prices, which can vary significantly from time to time.**
5. Up to $1M extra cost for the proposed structure at this site for the following reasons:
   - Containment at various stages
   - Steel erection inefficiency
   - Additional crane size and mobilizations
   - Bigger lifts/longer durations
   - Pumphouse protection/repairs
   - Additional site security (Park beside this site; adjacent to residential and institutional land uses)
   - Shoring (e.g. to protect standpipe; due to pool demolition disturbances of subsurface)
   - Other mobilization inefficiencies
6. Cost to demolish the community pool is excluded; assumed to be a Recreation budget item and not a water budget item.
7. Overall well pump capacity will reduce by 8%, but Township has excess surplus capacity. Assume would upgrade pumps at a future opportune well pump service interval for each of the four supplies.

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST WATER WORKS
NEW 2,420 m^3 COMPOSITE ELEVATED TANK AT GREENFIELD SITE
(Year 2020 Prices)

PRELIMINARY COST ESTIMATE

2420 m3 elevated steel tank and concrete pedestal	$2,500,000
Premium cost due to existing site constraints - not applicable	$0
Site work - allowance	$75,000
Electrical & controls - allowance	$50,000
Allowance for mech inside base of E.T. - assume included in base price	$0
Allowance for control room constructed within pedestal	$25,000
logos or striping	$20,000
allowance for flow paced chlorine equipment/controls + residual analyser + flow meter	$0
allowance for cathodic protection - appears to be included	$0
RUT & programming SCADA	$30,000
Upgrade/replace well pumps and motor starters - no change in operating head with this scenario	$0
Storm sewer to roadside ditch at a downstream location from the E.T., for the overflow	$10,000
Tank mixing system - if required	$25,000
Tank mixing system - existing standpipe	$35,000
Demolish existing standpipe	Not applicable
Subtotal construction	$2,770,000
Contingency (10%)	$277,000
TOTAL construction	**$3,047,000**
Engineering (Schedule B Class EA work)	$25,000
Geotechnical invesigation	$7,500
Engineering (assumed to be 8% of construction cost)	$243,800
TOTAL engineering	**$276,300**
Subtotal (Construction + Engineering)	$3,323,300
Net HST (1.76%)	$58,490
TOTAL (Construction + Engineering)	**$3,381,790**
MECP ECA Application fee	$2,200
TOTAL	**$3,383,990**

Say Total of **$3,400,000**

Cost per cubic metre of storage **$769**

NOTES:

1. The above **excludes** the following, where applicable

- off-site watermain, including connection to existing system	will be required - see separate cost estimates
- hydro line extension to service the site	included in the above
- off-site drainage/overflow works	included in the above
- access to site	Fronts on a gravel road
- control room in pedestal c/w heating & lighting	allowance included above
- containment for coatings operations, if applicable	Not applicable
- extra foundation costs if soil bearing capacity < 200 Kpa	Assume not applicable
- extra cost for special coating system, if desired/selected	Assume not applicable
- property purchase/property matters	Township already owns the property

2. Above based on a tank that is about 5-6m higher thatn the existing standpipe
3. Add/subtract $5,000 allowance per m of height of elevated tank — Not applicable
4. **A significant price component of elevated storage tanks is steel prices, which can vary significantly from time to time.**
5. Excludes cost for recoating/maintenance work for existing standpipe
6. Excludes costs related to Planning and matters associated with this site being located beyond the urban boundary within an adjacent municipality
7. E.T. Alternative #2 site fronts on an existing gravel road, Coral Lea Drive

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST WATER WORKS
NEW 4,420 m^3 COMPOSITE ELEVATED TANK AT GREENFIELD SITE
(Year 2020 Prices)

PRELIMINARY COST ESTIMATE

4420 m3 elevated steel tank and concrete pedestal - base price as per Landmark June 25/20 quote	$3,300,000
Extra cost for higher pedestal	$100,000
Site work - allowance	$75,000
Electrical & controls - allowance	$25,000
Allowance for mech inside base of E.T. - assume included in base price	$0
Allowance for control room constructed within pedestal - not required	$25,000
logos or striping	$20,000
allowance for flow paced chlorine equipment/controls + residual analyser + flow meter	$0
allowance for cathodic protection - appears to be included	$0
RUT & programming SCADA	$30,000
Upgrade/replace well pumps and motor starters for 5m higher operating head - excluded; see Note 7	$0
Off-site storm sewer for the overflow - excluded; See Note 8	$0
Tank mixing system - if required	$25,000
Demolish existing standpipe (assumes keep existing BPS building/mechanical - just disconnect)	$125,000
Subtotal construction	$3,725,000
Contingency (10%)	$372,500
TOTAL construction	**$4,097,500**
Engineering (Schedule B Class EA work)	$25,000
Geotechnical investigation	$7,500
Engineering (assumed to be 8% of construction cost)	$327,800
TOTAL engineering	**$360,300**
Subtotal (Construction + Engineering)	$4,457,800
Net HST (1.76%)	$78,457
TOTAL (Construction + Engineering)	**$4,536,257**
MECP ECA Application fee	$2,200
TOTAL	**$4,538,457**

Say Total of **$4,500,000**

Cost per cubic metre of storage **$1,018**

NOTES:

1. The above **excludes** the following, where applicable
   - off-site watermain, including connection to existing system — will be required - see separate cost estimates
   - hydro line extension to service the site — See Note 8
   - off-site drainage/overflow works — See Note 8
   - access to site — See Note 8
   - cost of property — Not applicable
   - control room in pedestal c/w heating & lighting — allowance included above
   - containment for coatings operations, if applicable — Not applicable
   - extra foundation costs if soil bearing capacity < 200 Kpa — Assume not applicable
   - extra cost for special coating system, if desired/selected — Assume not applicable
   - property purchase/property matters — Not applicable
2. Above based on a tank with an T.W.L. equal to the 2,420m3 alternative — 5-6m higher than the existing standpipe
3. Add/subtract $5,000 allowance per m of height of elevated tank — 20m higher than the Grant Street site E.T. height
4. **A significant price component of elevated storage tanks is steel prices, which can vary significantly from time to time.**
5. Up to $1M extra cost for the proposed structure at this site for the following reasons:
   - Containment at various stages
   - Steel erection inefficiency
   - Additional crane size and mobilizations
   - Bigger lifts/longer durations
   - Pumphouse protection/repairs
   - Additional site security (Park beside this site; adjacent to residential and institutional land uses)
   - Shoring (e.g. to protect standpipe; due to pool demolition disturbances of subsurface)
   - Other mobilization inefficiencies
6. Cost to demolish the community pool is excluded; assumed to be a Recreation budget item and not a water budget item.
7. Excludes costs related to Planning and matters associated with this site being located beyond the urban boundary within an adjacent municipality
8. E.T. Alternative #3 site fronts on a future extension of Industrial Drive, to service future lots. Costs of those works excluded from this estimate.

WATER WORKS PROJECTS

Water Storage	**Cost (See Note 1)**	**Comments**
E.T. (Alternative #1) - 4,420m3 at existing standpipe site	**$5,500,000**	
E.T. (Alternative #2) - Supplemental 2,420m3 storage at greenfield site north end of town	**$3,400,000**	Excludes off-site watermain
Repairs and recoating existing standpipe (i.e. part of Alternative #2)	**$950,000**	As per Township 2021 budget

Watermain (typically excludes cost of water services, except where noted)

Street	**From**	**To**	**Dia. (mm)**	**Cost (See Note 1)**	**Comments**
Queen Street	Main Street	Albert Street	N.A.	$133,000	See Note 3. Water services, fire hydrants, removals, misc.
Queen Street	Albert Street	York Street	150	$141,000	See Note 3. Includes water services.
Birmingham Street	East of Church Street	London Road	250	$247,000	
Cork Street	Waterloo Street	Princess Street	300	$183,000	includes water services one side
John Street	Queen Street	Waterloo Street	150	$217,000	includes water services
Sligo Road	Church Street	London Road	300	$435,000	
London Road	Sligo Road	Durham Street	250	$224,000	
Moynihan Place	Industrial Drive	Northeast of Industrial Drive	300	$147,500	
Mount Forest Drive	355m east of Main Street	Irwin Lytle Drive	250	$134,000	
South Water Street	Bristol Street	southwest of Bristol Street	300	$246,000	cost sharing with Developer; includes water services
South Water Street	Bristol Street	west of Main Street	150	$310,000	includes water services one side
Industrial Drive	north of Moynihan Place	Coral Lea Drive	300	$100,000	Needed to service new lots + New E.T. Alt. #2 or #3. 120m
Coral Lea Drive	Industrial Drive	New E.T. site	300	$237,000	Needed to service new lots + New E.T. Alternative #2 (275m)
Coral Lea Drive	New E.T. site	Highway No. 6	300	$306,000	Needed for New E.T. Alt.#2 looping (315m; Hwy #6 crossing)
Highway No. 6	Coral Lea Drive	OPP Station	300	$48,000	Needed for New E.T. Alternative #2 looping (65m)
Coral Lea Drive	Industrial Drive	Perth Street	300	$147,000	Needed for New E.T. Alt.#3 loop (215m)
Perth Street	Coral Lea Drive	south of Coral Lea Drive	300	$127,000	Needed for New E.T. Alt.#3 loop (175m; drainage ditch crossing)
Grant Street	east of Main Street	west of Parkside Drive	300	$102,000	See Note 5
Durham Street	Egremont Street	Fergus Street	250	$277,500	See Note 6. 150m. $1,850/lin.m
Fergus Street	Durham Street	Sligo Road	250	$582,750	See Note 6. 315m. $1,850/lin.m
Dublin Street	Queen Street	Princess Street	250	$777,000	420m. $1,850/lin.m incl. valves, fittings, hydrants, services
Murphy Street	Main Street	East of Main Street	250	$212,750	See Note 7. 115m. $1,850/lin.m
Queen Street	West of Cork Street	East of Sligo Road/Lovers Lane	250	$613,000	includes water services; **includes road reinstatement**
Replace all other old cast iron and undersized (<150mm dia.) watermains			150	$2,595,000	See Note 8. 1,730m @$1,500/lin.m incl. services, valves, etc.
		Total watermain:		**$8,542,500**	

Notes:

1. Above are Class 5 present value opinions of probable cost generally based on limited information, and includes construction, engineering and net HST (1.76%)
2. Above excludes Yr. 2020 active construction projects
3. Queen Street East costs assume works will be completed as part of a 90% Connecting Link grant and, therefore, eligible MTO portion of road reinstatement costs are excluded.
4. Above costs only include trench restoration and do not include any new roads or upgrades to existing roads.
5. If the selected water storage alternative will not include any storage facility on Grant Street, then this replacement watermain could likely be reduced to 150mm dia.
6. These sections are to replace old 100mm dia. cast iron watermain. Using 250mm dia. watermain would complete the Egremont Street trunk watermain loop to Sligo Road. Alternatively, could go north up Egremont and through Byeland Drive to Sligo Road. Per lineal metre price includes services, valves, fittings, hydrants, road reinstatement.
7. This old 100mm dia. cast iron watermain size depends on how servicing for future development east of Hwy. #6 proceeds. If may only need to be 150mm dia. if the primary connection is to the existing 250mm dia. Main Street watermain. Per lineal metre price includes services, valves, fittings, hydrants, road reinstatement.
8. Excludes the 48m of 38mm dia. line on the South side of Sligo Road west of Church Street and the 129m of 100mm dia. watermain on Queen Street west of Parkside Drive. These lines would be removed/abandoned and any related services reconnected to the watermain that exists on the opposite side of the street. Unit price per lineal metres includes fittings, valves, hydrants, services, and road reinstatement.

SANITARY WORKS PROJECTS

SPS	**Cost (See Note 1)**	**Comments**
South Water Street SPS	$866,000	

Sanitary Sewer (typically excludes cost of sanitary services, except where noted)

Street	**From**	**To**	**Dia. (mm)**	**Cost (See Note 1)**	**Comments**
Queen Street	Main Street	York Street	200	$346,000	See Note 3. Discontinuous segments. Includes sanitary services.
Birmingham Street	East of Church Street	London Road	375	$316,000	See Note 5.
Cork Street	Waterloo Street	Princess Street	300	$46,000	Repairs only
John Street	Queen Street	Waterloo Street	200	$158,000	includes sanitary services
Sligo Road	Church Street	London Road	375/250	$546,000	
London Road	Sligo Road	Durham Street	250	$216,000	
London Road	Durham Street	Birmingham Street	250	$131,000	
London Road	Birmingham Street	Broomer Crescent	250	$48,000	
Moynihan Place	Industrial Drive	Northeast of Industrial Drive	200	$106,000	includes sanitary services
Mount Forest Drive	150m east of Main Street	Irwin Lytle Drive	200	$286,000	
South Water Street	Bristol Street	southwest of Bristol Street	250	$231,000	cost sharing with Developer; includes sanitary services
South Water Street	Bristol Street	Main Street	300	$488,000	includes sanitary services
Murphy Street	Main Street	East of Main Street	300	$159,000	115m.; includes san services
Industrial Drive	north of Moynihan Place	Coral Lea Drive	300	$96,000	120m. Includes sanitary services
Coral Lea Drive	Industrial Drive	New E.T. site	300	$222,000	275m. Includes sanitary services
King Street	Fergus Street	Egremont Street	250	$160,000	includes sanitary services
Queen Street East	Cork Street	East of Sligo Road/Lovers Lane	300	$1,591,000	includes sanitary services; **includes C.L. road reinstatement**
Replace san sewer where other C.I. and undersized w/m being replaced			200	$7,182,000	See Note 6. 3,780m @$1,900/lin.m incl. services, MHs, etc.
		Total sanitary sewer		$12,328,000	

Notes:

1. Above are Class 5 present value opinions of probable cost generally based on limited information, and includes construction, engineering and net HST (1.76%)
2. Above excludes Yr. 2020 active construction projects
3. Queen Street East costs assume works will be completed as part of a 90% Connecting Link grant and, therefore, eligible MTO portion of road reinstatement costs are excluded.
4. Above costs only include trench restoration and do not include any new roads or upgrades to existing roads.
5. 375mm dia. as per the previous Master Plan study. Based on the probable revised extent of the catchment area, the size of sewer can probably be reduced.
6. These segments are: Birmingham Street, From Queen Street to east side of Main Street; Byeland Drive; Durham Street, from Main Street to 140m east of Egremont Street; Egremont Street, from Byeland Drive to Durham Street; Fergus Street, from Sligo Road to Birmingham Street; Wellington Street, from Fergus Street to Egremont Street; King Street, from Main Street to Fergus Street; Dublin Street, from Queen Street to Princess Street; Prince Charles Street; Peel Street; York Street.

APPENDIX F
WATERCAD

N

No.	DATE	REVISION
1	Jan. 6, 2021	Issued for Final Report

BMROSS
engineering better communities

Goderich | Mount Forest | Sarnia

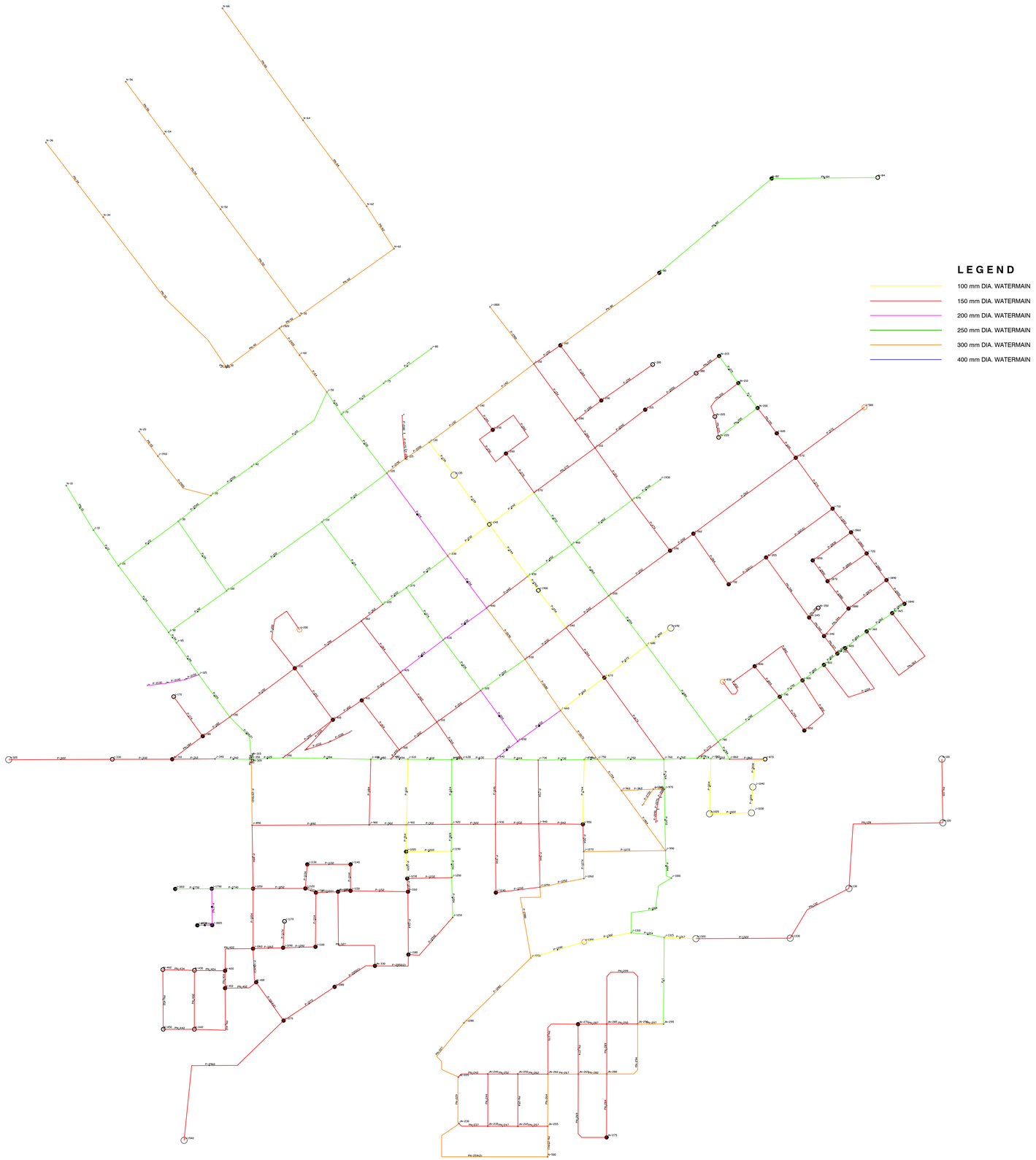
Township of Wellington North - Mount Forest Sanitary and Water Servicing Technical Update

WaterCAD Model Schematic (Full Model)

Project No. 20013

Scale N.T.S.

Drawing Exhibit No. W1



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No.	DATE	REVISION
1	Jan. 6, 2021	Issued for Final Report

BMROSS engineering better communities

Goderich | Mount Forest | Sarnia

Township of Wellington North - Mount Forest Sanitary and Water Servicing Technical Update

WaterCAD Model Schematic (Storage Alternative No. 2)

Project No. 20013

Scale: N.T.S.

Drawing: Exhibit No. W2

OFF=Topology OFF
ON=Topology ON
c=Hazen-Williams Coefficient

Model Component	Description	SCENARIO:	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	2-1	2-2	2-3	2-4	3-1	3-2	3-3	3-4	3-5	3-6	3-7	3-8
		RUN:	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21
			Available Fire Flow @ 140 kPa (L/s)				Available Pressure (kPa)				Available Fire Flow @ 140 kPa (L/s)				Available Fire Flow @ 140 kPa (L/s)							
			New E.T. #1 - 466.0 mASL, Pumps Off	New E.T. #1 - 457.50 mASL, Pumps Off	New E.T. #1 - 457.50 mASL, Pumps Off, PN-297 closed	New E.T. #1 - 457.50 mASL, Pumps Off, PN-297 closed, P-1282 increased to 300 mm	New E.T. #1 - 457.50 mASL, Pumps Off, Max day + N-66 @ 150 L/s	New E.T. #1 - 457.50 mASL, Pumps Off, Max day + N-66 @ 150 L/s, PN-68, PN-22 closed	New E.T. #1 - 457.50 mASL, Pumps Off, Max day + N-66 @ 150 L/s, PN-68 closed	New E.T. #1 - 457.50 mASL, Pumps Off, Max day + N-66 @ 150 L/s, PN-22 closed	Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off	Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off, P-894, P-1282 to 300 mm	Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off, PN-297, PN-98, PN-68 closed, P-894, P-1282 to 300 mm	Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off, P-894, P-1282 to 300 mm, Alternate Avila loop	New E.T. #3 - 457.50 mASL, all pumps OFF	New E.T. #3 - 462.50 mASL, all pumps OFF	New E.T. #3 - 457.5 mASL, all pumps OFF, PN-284 increased to 300 mm	New E.T. #3 - 462.5 mASL, all pumps OFF, PN-284 increased to 300 mm	New E.T. #3 - 457.5 mASL, all pumps OFF, Alternate Avila loop	New E.T. #3 - 462.5 mASL, all pumps OFF, Alternate Avila loop	See 3-2 Max day + JN-280 @ 150 L/s (Note: fire flow was supposed to be imposed on JN-275)	See 3-3 Max day + JN-280 @ 150 L/s (Note: fire flow was supposed to be imposed on JN-275)
														See below sketch					See below sketch	See below sketch		
			Max Day + Fire Flow Model Runs				Max Day Model Runs				Max Day + Fire Flow Model Runs				Max Day + Fire Flow Model Runs							
Water Storage																						
Existing Standpipe (mASL)	At Parkside Drive/Grant St		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	455	455	455	455	OFF	OFF	OFF	OFF	OFF	OFF		
New E.T. #1 (mASL)	At Parkside Drive/Grant St		466	457.5	457.5	457.5	457.5	457.5	457.5	457.5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
P-2720	Pipe connecting Exisiting/E.T. #1 to the system		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF		
New E.T. #2 (mASL)	At future Coral Lea Drive, east of Industrial Drive		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	455	455	455	455	OFF	OFF	OFF	OFF	OFF	OFF		
PN-3000	Pipe connecting E.T. #2 to the system		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF		
New E.T. #3 (mASL)	At future intersection of Coral Lea Drive and Industrial Drive		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	457.5	462.5	457.5	462.5	457.5	462.5		
PN-3002	Pipe connecting E.T. #3 to the system		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON		
PN-12	Future Coral Lea watermain looping to Perth Street		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON		
PN-22	Future Coral Lea watermain, from future extension of Industrial Drive to Norpark Avenue		ON	ON	ON	ON	ON	OFF	ON	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF		
Avila Subdivision																						
PN-297	Future Avila Street A watermain connection to Main Street watermain (i.e. for looping)		ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON	ON		
PN-267			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF	OFF		
PN-282	Avila side streets		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF	OFF		
PN-292			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF	OFF		
PN-502	Avila alternate loop		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	ON		
PN-284 (mm dia.)			150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	300, c=120	150, c=100	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120		
PN-264 (mm dia.)			300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120	150, c=100	150, c=100		
PN-259(1)			300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120	150, c=100	150, c=100		
PN-227																						
PN-229																						
PN-259(2)																						
PN-267																						
PN-282																						
PN-294																						
PN-297																						
PN-502																						
Other																						
P-1282 (mm dia.)	South Water Street watermain west of unopened Bristol Street		150, c=80	150, c=80	150, c=80	300, c=120	150, c=80	150, c=80	150, c=80	150, c=80	150, c=80	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120		
P-894 (mm dia.)	Cork Street watermain, Waterloo St to Princess St		150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120		
PN-98	Future Queen St watermain to Ayrshire Street		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON	ON		
PN-68	Future east extension of Mount Forest Drive watermain to loop to Irwin Lytle Drive watermain		ON	ON	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF	ON	ON	ON	ON	ON	ON	ON		
N-66	Custom fire flow run (L/s)						150	150	150	150												
JN-275	Custom fire flow run (L/s)																				150	150
JN-255	Custom fire flow run (L/s)																					
PN-88	London Road		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
SE of Murphy St. (New Pressure Zone)																						
PN-83			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
PN-90			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
PN-122			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
PN-124			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
JN-67	Watermain within higher elevation undeveloped urban area SE of Murphy Street		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
JN-68			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
JN-69			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
N-122			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
PN-86			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
PN-81			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
Sunvale Homes Subdivision (West of Cork St.)																						
N-400 to N-500	Junctions and pipes west of Cork St.		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
PN-402 to PN-452			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
Upgraded Pipes																						
P-614																						
P-914																						
P-1224																						
P-1234																						
P-144																						
P-250																						
P-270																						
P-442																						
P-662																						
P-672																						

OFF=Topology OFF
ON=Topology ON
c=Hazen-Williams Coefficient

Model Component	Description	SCENARIO:	4-1	4-1a	4-1b	4-1c	4-1d	4-2	4-3	4-3a	4-3b	4-3c	4-3d	4-3e	4-4	4-4a	4-4b	4-4c	4-5	4-6	4-7	4-8	4-9	4-10	4-11	5-1	5-2
		RUN:	22					23	24						25				26	27	28	29	30	31	32	33	34
			Available Fire Flow @ 140 kPa (L/s)																							Available Pressure (kPa)	
			Existing Standpipe - 455.0 mASL, Pumps Off	Existing Standpipe - 455.0 mASL, Pumps Off, Modify Avila to 250 mm	Existing Standpipe - 455.0 mASL, Pumps Off, Modify Avila to 250 mm, PN-297 closed	Existing Standpipe - 455.0 mASL, Pumps Off, Modify Alternate Avila Loop to 250 mm	Existing Standpipe - 455.0 mASL, Pumps Off, Modify Alternate Avila Loop to 250 mm, PN-284=200	New E.T. #1 - 457.50 mASL, Pumps Off	Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off	MDF for 50 yr. - 66.6 L/s additional flow added over Cork, Avila and North nodes Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off	MDF for 50 yr. - 66.6 L/s additional flow added over Cork, Avila and North nodes Standpipe + New E.T. #2 - 455.0 mASL, Pumps ON	MDF for 50 yr. - 66.6 L/s additional flow added over Cork, Avila and North nodes Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off	MDF for 50 yr. - 66.6 L/s additional flow added over Cork, Avila and North nodes Standpipe + New E.T. #2 - 455.0 mASL, Pumps Off	Same as 4-3a but Peak Rate for 50 yr. - 99.9 L/s ... below are the listed pressures	New E.T. #3 - 457.50 mASL, Pumps Off	This is not available fire flow analysis. This is Scenario 4-4 with 150L/s fire imposed at JN-255	New E.T. #3 - 457.50 mASL, Pumps Off, PN-22 open	New E.T. #3 - 457.50 mASL, Pumps ON, PN-22 open	New E.T. #3 - 457.50 mASL, Pumps Off, P-1224, P-1234 to 250 mm	New E.T. #3 - 457.50 mASL, Pumps Off, P-144, P-250, P-270, P-442 to 250 mm	New E.T. #3 - 457.50 mASL, Pumps Off, P-144, P-250, P-270 mm + P-662, P-672 to 200 mm	New E.T. #3 - 457.50 mASL, Pumps Off, P-1224, P-1234, P-1144, P-1244, P-1270, P-1442 to 250 mm, Modify Avila to 250 mm	New E.T. #3 - 457.50 mASL, Pumps Off, P-1224, P-1234 to 250 mm, PN-297 closed	New E.T. #3 - 457.50 mASL, Pumps Off, P-1224, P-1234 to 250 mm, Modify Alternate Avila Loop to 250 mm	New E.T. #3 - 462.00 mASL, Pumps Off, PN-502 closed, PN-86, PN-83, PN 90, PN-124, PN-122 open and 200 mm	Existing Standpipe - 455.0 mASL, Pumps Off	New E.T. #3 - 462.50 mASL, Pumps Off
			Item 9 to 11							Ultimate - 2021-01-04 email						Item 12 from Frank's email - 2020/08/21											
			Max Day + Fire Flow Model Runs																								
Water Storage																											
Existing Standpipe (mASL)	At Parkside Drive/Grant St		455	455	455	455	455	OFF	455	455	455	455	455	455	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	455	OFF
New E.T. #1 (mASL)	At Parkside Drive/Grant St		OFF	OFF	OFF	OFF	OFF	457.5	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
P-2720	Pipe connecting Exisiting/E.T. #1 to the system		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
New E.T. #2 (mASL)	At future Coral Lea Drive, east of Industrial Drive		OFF	OFF	OFF	OFF	OFF	OFF	455	455	455	455	455	455	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
PN-3000	Pipe connecting E.T. #2 to the system		OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
New E.T. #3 (mASL)	At future intersection of Coral Lea Drive and Industrial Drive		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	457.5		457.5	457.5	457.5	457.5	457.5	457.5	457.5	457.5	462	OFF	462.5
PN-3002	Pipe connecting E.T. #3 to the system		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON
PN-12	Future Coral Lea watermain looping to Perth Street		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	ON
PN-22	Future Coral Lea watermain, from future extension of Industrial Drive to Norpark Avenue		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
Avila Subdivision																											
PN-297	Future Avila Street A watermain connection to Main Street watermain (i.e. for looping)		ON	ON	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON	ON
PN-267			ON	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON
PN-282	Avila side streets		ON	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON
PN-292			ON	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	ON	OFF	ON	ON	ON
PN-502	Avila alternate loop		OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
P-284 (mm dia.)			150, c=100	250, c=110	250, c=110	250, c=110	200, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100		150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	250, c=110	250, c=110	250, c=110	150, c=100	150, c=100	150, c=100
P-264 (mm dia.)			300, c=120	250, c=110	250, c=110	150, c=100	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120		300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	250, c=110	250, c=110	150, c=100	300, c=120	300, c=120	300, c=120
P-259(1)			300, c=120	250, c=110	250, c=110	150, c=100	150, c=100	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120		300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	250, c=110	250, c=110	150, c=100	300, c=120	300, c=120	300, c=120
P-227				250, c=110	250, c=110	250, c=110	250, c=110															250, c=110	250, c=110	250, c=110			
P-229				250, c=110	250, c=110	250, c=110	250, c=110															250, c=110	250, c=110	250, c=110			
P-259(2)				250, c=110	250, c=110	250, c=110	250, c=110															250, c=110	250, c=110	250, c=110			
P-267				250, c=110	250, c=110	-	-															250, c=110	250, c=110	-			
P-282				250, c=110	250, c=110	-	-															250, c=110	250, c=110	-			
P-294				250, c=110	250, c=110	250, c=110	250, c=110															250, c=110	250, c=110	250, c=110			
P-297				250, c=110	250, c=110	250, c=110	250, c=110															250, c=110	250, c=110	250, c=110			
P-502						250, c=110	250, c=110																	250, c=110			
Other																											
P-1282 (mm dia.)	South Water Street watermain west of unopened Bristol Street		300, c=120	250, c=110	250, c=110	250, c=110	250, c=110	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	300, c=120		300, c=120	300, c=120	300, c=120	300, c=120	300, c=120	250, c=110	250, c=110	250, c=110	300, c=120	300, c=120	300, c=120
P-894 (mm dia.)	Cork Street watermain, Waterloo St to Princess St		150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100		150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100	150, c=100
PN-98	Future Queen St watermain to Ayrshire Street		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-68	Future east extension of Mount Forest Drive watermain to loop to Irwin Lytle Drive watermain		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
N-66	Custom fire flow run (L/s)																										
JN-275	Custom fire flow run (L/s)																										
JN-255	Custom fire flow run (L/s)															150											
PN-88	London Road		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
SE of Murphy St. (New Pressure Zone)																											
PN-83			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-90			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-122			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-124			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
JN-67	Watermain within higher elevation undeveloped urban area SE of Murphy Street		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
JN-68			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
JN-69			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
N-122			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-86			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
PN-81			OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
Sunvale Homes Subdivision (West of Cork St.)																											
N-400 to N-500	Junctions and pipes west of Cork St.		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
PN-402 to PN-452			ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Upgraded Pipes																											
P-614																			250, c=110	250, c=110	250, c=110	250, c=110	250, c=110	250, c=110			
P-914																			250, c=110	250, c=110	250, c=110	250, c=110	250, c=110	250, c=110			
P-1224																			250, c=110	250, c=110	250, c=110	250, c=110	250, c=110	250, c=110			
P-1234																			250, c=110	250, c=110	250, c=110	250, c=110	250, c=110	250, c=110			
P-144																				250, c=110	250, c=110						
P-250																				250, c=110	250, c=110						
P-270																				250, c=110	250, c=110						
P-442																				250, c=110							
P-662																					200, c=100						
P-672																					200, c=100						

(NA)' results indicate topology turned off so those nodes not included in the model run evaluation

Select junctions are color coded below to indicate what the target level of available fire flow has been set to

50-75	L/s (residential; target of 75L/s for higher density type residential type developments; residential fire flow should be >38L/s)
150	L/s (ICI)
225	L/s (Downtown business core - contiguous type old buildings)
	Where is residential land use and <50L/s available fire flow
	Where is ICI land use and <150L/s available fire flow

Junction	Description	2-1	2-2	Run 2-2 minus Run 2-1	2-3	Run 2-3 minus Run 2-2	2.4	Run 2-4 minus Run 2-2	4-1	4-1a	Run 4-1a minus Run 4-1	4-1b	Run 4-1b minus Run 4-1	4-1c	Run 4-1c minus Run 4-1	4-1d	Run 4-1d minus Run 4-1	4-2	Run 4-2 minus Run 4-1	4-3	Run 4-3 minus Run 4-1		Run 4-3 minus Run 4-2
J-10	industrial	243	243	0	243	-0	243	0	192	192	0	192	0	192	0	192	0	202	9	223	31	16%	21
J-20	industrial	350	350	0	350	-0	350	-0	237	237	0	236	-1	237	0	237	0	249	12	298	61	26%	49
J-30	industrial	424	424	0	424	-0	424	-0	226	225	0	225	-1	225	0	225	0	240	14	308	82	36%	68
J-35	industrial	500	500	0	500	0	500	0	216	216	0	216	0	216	0	216	0	229	12	298	82	38%	69
J-40	industrial	399	399	0	398	-1	399	0	208	208	0	208	0	208	0	208	0	220	12	300	92	44%	81
J-50	industrial, commercial	500	500	0	500	0	500	0	193	193	0	193	0	193	0	193	0	206	13	500	307	159%	294
J-60	commercial, OPP Station	500	500	0	500	0	500	0	176	176	0	176	0	176	0	176	0	188	12	500	324	184%	312
J-70	commercial	500	500	0	462	-38	500	0	205	205	0	205	0	205	0	205	0	219	14	418	213	104%	199
J-75	industrial, commercial	365	365	0	240	-125	365	-0	169	168	0	168	0	168	0	168	0	178	10	232	63	37%	54
J-80	industrial; east end of existing Mount Forest Drive	341	341	0	175	-166	341	0	139	139	0	139	0	139	0	139	0	147	8	172	33	23%	25
J-90	industrial	389	391	1	390	-1	391	-0	252	251	0	251	-1	251	-1	251	-1	266	14	328	77	30%	62
J-95	industrial	369	370	1	370	-1	370	0	250	250	-1	249	-1	250	-1	250	-1	264	14	320	69	28%	55
J-100	industrial	422	422	1	422	-1	422	-0	256	256	-1	256	-1	256	-1	256	-1	271	15	346	90	35%	75
J-105	industrial	337	338	2	338	-1	338	-0	248	247	-1	247	-1	247	-1	247	-1	262	14	304	57	23%	43
J-110	industrial	484	484	0	479	-5	484	-0	278	278	-1	277	-1	278	-1	278	-1	299	21	434	156	56%	135
J-120	industrial, commercial	500	500	0	460	-40	500	0	248	248	-1	247	-1	248	-1	248	-1	267	19	390	141	57%	123
J-125	commercial	492	492	0	414	-78	492	0	239	239	0	238	-1	239	-1	239	-1	257	18	354	115	48%	97
J-130		461	461	0	374	-87	461	-0	229	229	0	229	-1	229	0	229	0	246	17	322	93	41%	76
J-135	Fergus St, south of Sligo Road	35	35	0	35	-0	35	0	35	35	0	35	0	35	0	35	0	37	2	35	1	1%	-2
J-140		426	426	0	319	-107	426	-0	212	211	0	211	-1	211	0	211	0	228	16	277	65	31%	50
J-150	H. Bye yard, high school, apartments	372	372	0	270	-102	372	0	190	190	0	190	0	190	0	190	0	204	14	234	44	23%	30
J-160	Reeves yard, high school	218	218	-0	209	-10	218	0	104	104	0	104	0	104	0	104	0	111	7	111	6	6%	-0
J-170		62	62	0	62	-0	62	0	61	61	0	61	0	61	0	61	0	64	3	62	1	2%	-2
J-180		130	130	0	130	-0	130	0	122	122	0	122	0	122	0	122	0	129	7	128	6	5%	-1
J-190		335	339	3	338	-1	339	-0	259	258	-1	258	-1	258	-1	258	-1	274	15	311	52	20%	37
J-200	Dead-end Silverbirch watermain	44	44	-0	44	-0	44	0	43	43	0	43	0	43	0	43	0	46	3	44	1	2%	-2
J-210		132	132	0	132	-0	132	0	123	123	0	123	0	123	0	123	0	131	8	130	7	6%	-1
J-220		454	454	0	449	-5	454	0	314	313	-1	313	-1	313	-1	313	-1	338	24	422	108	34%	84
J-230		413	413	0	408	-5	413	-0	306	306	-1	306	-1	306	-1	306	-1	323	17	388	82	27%	65
J-240		56	56	-0	56	-0	56	0	54	54	0	54	0	54	0	54	0	58	4	55	1	2%	-3
J-250		120	120	-0	119	-2	120	0	112	112	0	112	0	112	0	112	0	118	6	118	6	5%	-1
J-260		97	97	-0	96	-1	97	0	91	91	0	91	0	91	0	91	0	98	7	95	4	4%	-2
J-270		259	259	-0	253	-6	259	0	221	221	0	221	0	221	0	221	0	234	13	241	20	9%	7
J-280	H. Bye yard (but really serviced at Sligo J-150)	161	161	-0	157	-4	161	0	141	141	0	141	0	141	0	141	0	149	8	151	10	7%	1
J-290		119	119	0	117	-2	119	0	104	104	0	104	0	104	0	104	0	110	6	109	5	5%	-1
J-300		55	55	0	55	-0	55	0	53	53	0	53	0	53	0	53	0	56	3	54	1	2%	-2
J-310	industrial	174	174	-0	170	-4	174	0	155	155	0	155	0	155	0	155	0	165	10	165	10	6%	1
J-315		97	97	-0	96	-1	97	0	81	81	0	81	0	81	0	81	0	86	5	83	2	2%	-3
J-320	commercial (McLellans)	37	37	0	37	-0	37	0	37	37	0	37	0	37	0	37	0	38	2	37	0	1%	-1
J-330	commercial	53	53	0	53	-0	53	0	52	52	0	52	0	52	0	52	0	55	3	53	1	2%	-2
J-340	industrial, commercial	241	243	2	243	-1	243	0	206	205	-1	205	-1	205	-1	205	-1	218	13	232	26	13%	13
J-350	commercial; feeding to Sports Complex	322	328	6	326	-1	328	-0	254	253	-1	253	-1	253	-1	253	-1	270	16	302	48	19%	32

J-360		196	196	0	196	-0	196	0	178	177	0	177	0	177	0	177	0	187	9	193	15	8%	6
J-370		498	498	0	491	-7	498	-0	321	321	-1	320	-1	321	-1	321	-1	346	25	461	140	43%	115
J-380		114	114	0	113	-1	114	0	73	73	0	73	0	73	0	73	0	77	5	74	1	2%	-3
J-390		347	350	3	349	-1	350	-0	272	271	-1	271	-1	271	-1	271	-1	289	17	329	57	21%	40
J-400		137	137	0	137	-0	137	0	128	127	0	127	0	127	0	127	0	136	8	135	7	6%	-1
J-410		140	140	0	140	-0	140	0	130	130	0	130	0	130	0	130	0	140	9	138	8	6%	-1
J-420		238	238	0	237	-1	238	0	208	208	0	208	0	208	0	208	0	221	13	232	23	11%	11
J-430		500	500	0	494	-6	500	0	356	355	-1	355	-1	355	-1	355	-1	384	28	468	112	32%	84
J-440		484	484	0	478	-7	484	-0	352	351	-1	351	-1	351	-1	351	-1	384	32	453	101	29%	69
J-450	apartment (is 150 L/s required?)	282	282	-0	277	-5	282	0	240	240	0	240	0	240	0	240	0	253	13	262	22	9%	9
J-460	Seniors/Nursing Home	348	348	0	336	-12	348	0	261	260	-1	260	-1	260	-1	260	-1	288	27	304	44	17%	16
J-470	apartment (is 150 L/s required?)	291	291	0	281	-10	291	0	214	213	0	213	0	213	0	213	0	226	12	230	17	8%	4
J-480		348	348	0	346	-2	348	-0	285	285	-1	284	-1	285	-1	285	-1	301	16	332	46	16%	30
J-490		355	355	0	353	-2	355	-0	288	287	-1	287	-1	287	-1	287	-1	306	17	338	50	17%	32
J-500		218	218	0	217	-1	218	-0	195	194	0	194	-1	194	0	194	0	207	12	212	18	9%	5
J-510		244	244	0	243	-1	244	-0	218	218	0	218	-1	218	0	218	0	230	12	238	20	9%	8
J-520		500	500	0	500	0	500	0	364	363	-1	363	-2	363	-1	363	-1	410	45	489	124	34%	79
J-530		500	500	0	500	0	500	0	361	360	-1	359	-1	360	-1	360	-1	406	45	500	139	39%	94
J-540	churches	169	169	0	169	-1	169	0	160	160	0	160	0	160	0	160	0	169	9	167	7	4%	-2
J-550		300	300	0	291	-8	300	0	246	246	0	246	0	246	0	246	0	263	17	272	26	10%	9
J-560		120	120	0	119	-1	120	0	110	110	0	110	0	110	0	110	0	117	8	113	3	3%	-4
J-570		121	121	0	120	-1	121	0	93	93	0	93	0	93	0	93	0	99	6	95	2	2%	-4
J-580	East end of Wellington Street East	44	44	0	44	-0	44	0	41	41	0	41	0	41	0	41	0	44	3	42	0	1%	-2
J-590		144	144	0	142	-1	144	0	132	132	0	132	0	132	0	132	0	141	9	138	5	4%	-4
J-600		121	121	0	120	-1	121	0	77	77	0	77	0	77	0	77	0	83	5	79	2	2%	-4
J-610		356	356	0	354	-2	356	-0	290	290	-1	289	-1	290	-1	290	-1	308	17	339	49	17%	31
J-620		406	418	12	414	-3	418	-0	310	309	-1	308	-2	308	-2	308	-2	333	23	380	70	23%	48
J-630		433	445	12	441	-4	445	-0	325	323	-2	322	-2	323	-2	323	-2	348	24	404	79	24%	56
J-640		500	500	0	500	0	500	0	379	377	-2	376	-3	377	-2	377	-2	407	28	484	105	28%	78
J-650		408	409	0	406	-3	409	-0	336	336	-1	335	-1	336	-1	336	-1	356	19	392	55	16%	36
J-660		500	500	0	500	0	500	0	381	380	-1	379	-2	380	-1	380	-1	429	48	500	119	31%	71
J-670		134	134	0	133	-0	134	0	129	129	0	129	0	129	0	129	0	137	7	133	3	3%	-4
J-680		275	275	0	269	-7	275	0	237	237	0	237	0	237	0	237	0	253	16	257	20	8%	4
J-690	Old arena (church use?)	29	29	0	29	-0	29	0	29	29	0	29	0	29	0	29	0	31	2	29	0	1%	-2
J-700		86	86	0	85	-0	86	0	80	80	0	80	0	80	0	80	0	86	6	82	2	2%	-4
J-710	Church at King/London Road	115	115	0	114	-1	115	0	103	103	0	103	0	103	0	103	0	110	7	106	3	3%	-5
J-720		106	106	0	105	-1	106	0	97	96	0	96	0	96	0	96	0	106	9	100	3	3%	-6
J-730		428	429	1	425	-3	429	-0	355	355	-1	354	-2	355	-1	355	-1	379	24	411	55	16%	31
J-740		467	468	0	463	-4	468	-0	372	371	-1	371	-1	371	-1	371	-1	403	31	444	71	19%	40
J-750		500	500	0	500	0	500	0	413	412	-1	411	-2	412	-1	412	-1	466	53	500	87	21%	34
J-760	number of churches	413	413	0	403	-9	413	0	331	330	-1	330	-1	330	-1	330	-1	372	41	385	54	16%	13
J-770		277	277	0	265	-11	277	0	228	228	0	228	-1	228	0	228	0	257	29	254	26	11%	-3
J-780		254	254	0	243	-11	254	0	208	208	0	208	0	208	0	208	0	233	25	230	22	11%	-3
J-790		157	157	0	154	-3	157	0	139	139	0	139	0	139	0	139	0	155	17	148	9	6%	-8
J-800		147	147	0	145	-2	147	0	131	131	0	131	0	131	0	131	0	147	16	138	8	6%	-8
J-810		136	136	0	134	-2	136	-0	122	122	0	122	0	122	0	122	0	137	15	129	7	5%	-8
J-820		128	128	0	126	-2	128	0	115	115	0	115	0	115	0	115	0	129	14	121	6	5%	-8
J-830		44	44	0	44	-0	44	0	43	43	0	43	0	43	0	43	0	46	3	43	1	1%	-3
J-840		90	90	0	89	-1	90	0	86	86	0	86	0	86	0	86	0	93	7	88	2	2%	-5
J-850		90	90	0	89	-1	90	0	86	86	0	86	0	86	0	86	0	94	8	88	2	2%	-5
J-860		257	257	0	240	-16	257	0	209	209	0	209	0	209	0	209	0	236	27	231	21	10%	-5
J-870		82	83	0	69	-14	83	-0	67	67	0	67	0	67	0	67	0	74	7	68	1	2%	-6
J-890	Feeding to Sports Complex	263	273	10	272	-1	273	-0	230	229	-1	229	-1	229	-1	229	-1	241	11	255	25	11%	13
J-900		167	167	0	167	-0	167	0	157	157	0	156	0	157	0	157	0	165	8	165	8	5%	-0
J-910	Unused commercial expected to become residential	176	176	0	176	-0	176	0	165	165	0	165	0	165	0	165	0	173	8	174	9	5%	0
J-920	RONA building supply	291	312	21	310	-2	312	-0	245	244	-1	243	-2	244	-1	244	-1	263	18	280	35	14%	17
J-930		216	217	1	215	-2	217	-0	203	203	0	202	-1	203	0	203	0	216	13	214	10	5%	-2
J-940		209	210	1	207	-3	210	-0	199	199	0	197	-2	199	-1	199	-1	213	14	207	8	4%	-5
J-950		148	149	1	147	-2	149	-0	144	144	0	143	-1	144	0	144	0	155	10	148	3	2%	-7
J-960	commercial	500	500	0	500	0	500	0	490	488	-1	488	-1	488	-1	488	-1	500	10	500	10	2%	0
J-970	Elementary school	500	500	0	500	0	500	0	500	500	0	500	0	500	0	500	0	500	0	500	0	0%	0

J-990		500	500	0	500	0	500	0	438	436	-2	433	-4	435	-2	435	-2	474	37	492	55	13%	18
J-1000	250mm dia. river crossing	307	347	40	264	-83	347	-1	317	305	-11	249	-67	302	-14	299	-17	338	21	334	17	6%	-4
J-1010		253	253	0	241	-12	253	0	210	210	0	210	0	210	0	210	0	237	27	231	21	10%	-5
J-1020	York-Peel 100mm dia. watermain loop	20	20	0	20	-0	20	0	20	20	0	20	0	20	0	20	0	22	2	20	0	1%	-2
J-1030	York-Peel 100mm dia. watermain loop	22	22	0	22	-0	22	0	22	22	0	22	0	22	0	22	0	24	2	22	0	1%	-2
J-1040	York-Peel 100mm dia. watermain loop	27	27	0	26	-0	27	0	26	26	0	26	0	26	0	26	0	29	3	26	0	1%	-2
J-1050	Feeding to Sports Complex	122	249	126	248	-1	249	-0	118	117	-1	117	-1	117	-1	117	-1	124	6	121	4	3%	-2
J-1060		102	128	26	128	-0	128	-0	99	98	-1	98	-1	98	-1	98	-1	104	5	101	2	2%	-2
J-1070		82	92	10	92	-0	92	0	80	79	-1	79	-1	79	-1	79	-1	84	4	82	2	2%	-2
J-1080		81	90	8	90	-0	90	0	79	79	-1	79	-1	79	-1	79	-1	84	4	81	2	2%	-3
J-1090		90	106	17	106	-0	106	0	87	86	-1	86	-1	86	-1	86	-1	92	4	89	2	2%	-2
J-1100		87	101	15	101	-0	101	0	84	84	-1	84	-1	84	-1	84	-1	89	4	86	2	2%	-3
J-1110		113	143	30	143	-0	143	-0	108	108	-1	108	-1	108	-1	108	-1	114	6	112	3	3%	-3
J-1120		111	145	33	145	-0	145	0	107	106	-1	106	-1	106	-1	106	-1	113	6	110	4	3%	-3
J-1130		91	107	16	107	-0	107	0	88	88	-1	88	-1	88	-1	88	-1	94	5	91	2	3%	-3
J-1140		89	103	14	103	-0	103	0	86	85	-1	85	-1	85	-1	85	-1	91	5	88	2	3%	-3
J-1150	Nursing Home	104	126	22	126	-0	126	0	100	99	-1	99	-1	99	-1	99	-1	106	7	103	3	3%	-3
J-1160	Hospital, Medical Clinic, Nursing Home	122	135	13	135	-0	135	-0	116	115	-1	115	-1	115	-1	115	-1	124	8	121	5	4%	-3
J-1170		66	73	7	73	-0	73	0	65	65	0	65	0	65	0	65	0	68	3	66	1	2%	-2
J-1180	Hospital, Medical Clinic	111	122	11	122	-0	122	-0	106	105	-1	105	-1	105	-1	105	-1	114	8	110	4	4%	-3
J-1190		247	270	23	269	-1	270	-0	215	214	-1	213	-2	214	-1	214	-1	231	16	240	24	11%	9
J-1200	Hospital	220	239	19	239	-1	239	-0	196	194	-1	194	-2	194	-1	194	-1	210	14	215	19	10%	5
J-1210	Hospital	193	202	9	202	-0	202	-0	178	177	-1	177	-1	177	-1	177	-1	189	11	190	12	7%	1
J-1220		81	81	1	81	-0	81	0	78	78	0	78	0	78	0	78	0	83	5	80	2	2%	-3
J-1230		128	137	9	136	-0	137	-0	121	120	-1	120	-1	120	-1	120	-1	129	8	126	5	4%	-3
J-1240		128	129	1	127	-1	129	-0	126	126	0	125	-1	126	0	126	0	133	7	128	2	2%	-5
J-1250		369	392	23	291	-102	395	3	335	356	21	271	-63	355	20	354	19	363	28	363	28	8%	-0
J-1260		403	424	22	329	-95	425	1	359	378	19	304	-55	378	19	377	18	389	30	392	33	9%	3
J-1270		398	415	16	364	-51	414	-0	371	368	-4	332	-40	367	-4	366	-5	396	25	400	28	8%	4
J-1280	West end of existing South Water Street roadway	151	281	130	172	-109	284	3	247	231	-16	129	-118	227	-21	222	-26	268	21	260	12	5%	-8
J-1290		339	322	-17	214	-108	325	3	280	307	26	205	-76	311	30	305	25	304	23	298	17	6%	-6
J-1300	100mm South Water Street watermain	42	42	0	42	-0	42	0	42	42	0	42	0	42	0	42	0	44	2	42	0	0%	-2
J-1310		194	274	79	153	-121	271	-3	238	211	-27	149	-89	208	-30	205	-33	254	16	247	9	4%	-7
J-1315		173	248	75	133	-116	245	-3	216	192	-24	130	-86	189	-27	185	-30	230	15	223	7	3%	-8
J-1320	Murphy Street	59	60	1	49	-11	60	-0	21	21	0	21	0	21	0	21	0	22	1	21	0	0%	-1
J-1330	Future east extension of Murphy Street watermain	63	65	1	44	-20	64	-0	18	18	0	18	0	18	0	18	0	20	1	18	0	0%	-1
J-1340		500	500	0	500	0	500	0	500	500	0	500	0	500	0	500	0	500	0	500	0	0%	0
J-1790	Sports Complex	116	202	85	201	-0	202	-0	112	111	-1	111	-1	111	-1	111	-1	118	5	115	3	3%	-2
J-1800	Future industrial (Irwin Lytle Drive), apartments	314	314	0	213	-101	314	0	165	165	0	165	0	165	0	165	0	177	12	193	28	17%	16
J-1810		113	179	66	179	-0	179	-0	109	109	-1	108	-1	109	-1	109	-1	114	5	112	3	3%	-2
J-1820	Sports Complex	100	143	43	142	-0	143	-0	97	96	-1	96	-1	96	-1	96	-1	101	5	99	2	2%	-2
J-1830	Sports Complex	95	130	35	129	-0	130	-0	92	92	-1	92	-1	92	-1	92	-1	96	4	94	2	2%	-2
J-1840		125	125	0	124	-1	125	0	115	115	0	115	0	115	0	115	0	126	11	120	4	4%	-6
J-1850		85	85	0	85	-0	85	0	80	80	0	80	0	80	0	80	0	87	6	82	2	2%	-5
J-1860		108	108	0	107	-1	108	0	98	98	0	98	0	98	0	98	0	108	9	102	3	3%	-6
J-1870		88	88	0	88	-1	88	0	82	82	0	82	0	82	0	82	0	90	8	85	2	3%	-6
J-1880		98	98	0	97	-1	98	0	91	91	0	91	0	91	0	91	0	100	9	94	3	3%	-6
J-1890		110	110	0	109	-1	110	0	102	102	0	102	0	102	0	102	0	110	9	105	3	3%	-5
J-1900		55	55	0	55	-0	55	0	54	54	0	54	0	54	0	54	0	57	3	55	1	1%	-2
J-1910		500	500	0	500	0	500	0	203	203	0	203	0	203	0	203	0	213	10	257	54	27%	44
J-1920	Egremont annexation lands (future unserviced land)	500	500	0	500	0	500	0	166	166	0	166	0	166	0	166	0	177	11	500	334	201%	323
J-1930		264	264	0	256	-8	264	0	179	179	0	179	0	179	0	179	0	189	10	190	10	6%	0
J-1940	WWTP	34	35	1	35	-0	35	0	34	34	0	34	0	34	0	34	0	35	2	34	0	1%	-1
JN-67	Future development lands SE of Murphy St	58	60	2	46	-14	60	-0	(N/A)	(N/A)	#VALUE!	(N/A)	####	(N/A)	####	(N/A)	####	(N/A)		(N/A)	#VALUE!	#VALUE!	#VALUE!
JN-68	Future development lands SE of Murphy St	(N/A)	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	(N/A)	#VALUE!	(N/A)	####	(N/A)	####	(N/A)	####	(N/A)		(N/A)	#VALUE!	#VALUE!	#VALUE!
JN-69	Future development lands SE of Murphy St	(N/A)	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	(N/A)	#VALUE!	(N/A)	####	(N/A)	####	(N/A)	####	(N/A)		(N/A)	#VALUE!	#VALUE!	#VALUE!
JN-200	Birmingham/London Rd intersection	234	234	0	226	-7	234	0	75	75	0	75	0	75	0	75	0	79	5	76	1	2%	-3
JN-205	Wilson's London Rd subdivision (future unserviced)	139	139	0	137	-2	139	0	67	67	0	67	0	67	0	67	0	71	4	68	1	2%	-3
JN-210	London Rd w/m at future Wilson's subdivision entrance	235	235	-0	227	-8	235	0	75	75	0	75	0	75	0	75	0	80	5	76	1	2%	-3
JN-215	Durham/London Rd. intesection	233	233	-0	225	-8	233	0	76	75	0	75	0	75	0	75	0	80	5	77	1	2%	-3
JN-220	Birmingham St watermain (future unserviced)	241	241	0	233	-8	241	0	73	73	0	73	0	73	0	73	0	78	5	75	1	2%	-3

JN-225	Avila subdivision	149	258	109	151	-107	261	3	228	198	-30	105	-124	194	-34	190	-39	247	19	238	10	4%	-9
JN-230	Avila subdivision	148	250	101	143	-106	252	3	222	186	-36	98	-124	184	-38	179	-42	240	18	231	9	4%	-9
JN-235	Avila subdivision	122	164	42	127	-37	157	-7	157	142	-16	96	-62	137	-21	135	-23	167	9	160	3	2%	-6
JN-240	Avila subdivision	124	167	43	130	-37	160	-7	161	146	-15	96	-64	139	-21	138	-23	170	9	164	3	2%	-6
JN-245	Avila subdivision	121	162	41	123	-39	145	-16	155	140	-15	92	-63	128	-27	127	-28	164	9	158	3	2%	-6
JN-250	Avila subdivision	124	165	41	125	-40	146	-19	158	143	-15	91	-67	129	-29	128	-30	167	9	161	3	2%	-6
JN-255	Avila subdivision	146	232	86	129	-103	150	-82	207	173	-34	88	-119	131	-76	129	-78	224	17	215	8	4%	-9
JN-260	Avila subdivision	145	225	80	124	-100	136	-88	201	181	-20	85	-116	122	-79	122	-80	218	17	208	7	4%	-9
JN-265	Avila subdivision	144	220	76	121	-99	95	-125	197	176	-22	82	-115	89	-108	89	-109	214	16	204	7	4%	-9
JN-270	Avila subdivision	118	148	29	107	-41	125	-23	141	130	-11	80	-61	113	-28	113	-28	150	9	144	2	2%	-7
JN-275	Avila subdivision - highway commercial	82	92	10	78	-14	224	132	90	143	53	81	-9	163	73	153	63	96	6	91	1	1%	-5
JN-280	Avila subdivision - highway commercial	144	217	73	119	-98	216	-1	195	171	-23	80	-114	171	-23	165	-30	211	16	201	7	3%	-9
JN-285	Avila subdivision	128	167	38	110	-56	129	-37	157	142	-15	79	-78	116	-41	116	-41	168	10	161	3	2%	-7
JN-290	Avila subdivision	142	209	66	113	-95	206	-3	188	165	-23	77	-111	162	-26	158	-30	203	15	194	6	3%	-9
JN-295	Existing south end of Main Street trunk watermain	141	205	63	106	-98	202	-2	185	160	-25	102	-83	157	-28	154	-31	200	15	191	6	3%	-9
JN-310	Durham/Queen intersection	116	116	0	116	-0	116	0	110	109	0	109	0	109	0	109	0	116	7	115	5	5%	-1
JN-315	At Queen/Cork	325	331	6	330	-1	331	-0	256	255	-1	255	-1	255	-1	255	-1	272	16	305	49	19%	33
JN-320	At Queen/Cork	275	285	10	285	-1	285	-0	237	236	-1	236	-1	236	-1	236	-1	249	12	265	28	12%	16
JN-325	At Princess St entrance to Strathcona	107	133	25	132	-0	133	0	103	102	-1	102	-1	102	-1	102	-1	109	6	107	3	3%	-3
JN-330	At Martin St entrance to Strathcona	99	111	12	110	-0	111	0	95	94	-1	94	-1	94	-1	94	-1	101	6	98	3	3%	-3
JN-335	At Albert St entrance to Lucas subdivision	131	131	0	130	-2	131	0	118	118	0	118	0	118	0	118	0	132	14	124	6	5%	-8
JN-340	Ronnie's Way	105	105	0	104	-1	105	0	97	96	0	96	0	96	0	96	0	107	10	100	3	4%	-7
JN-345	Ronnie's Way	84	84	0	83	-0	84	0	79	79	0	79	0	79	0	79	0	86	7	81	2	3%	-5
JN-350	Doug's Court	64	64	0	64	-0	64	0	62	62	0	62	0	62	0	62	0	67	6	63	1	2%	-5
JN-355	At King St entrance to Lucas subdivision	101	101	0	100	-1	101	0	93	93	0	93	0	93	0	93	0	100	7	95	2	2%	-4
JN-360	At Albert St entrance to west leg of Ruby's Crescent	125	125	0	124	-1	125	0	114	114	0	114	0	114	0	114	0	126	12	119	5	4%	-7
JN-365	At Albert St entrance to east leg of Ruby's Crescent	126	126	0	124	-1	126	0	115	115	0	115	0	115	0	115	0	126	11	120	5	4%	-7
N-10	Perth/Coral Lea intersection (future unserviced land)	189	189	0	189	-0	189	0	160	160	0	160	0	160	0	160	0	168	8	178	18	11%	10
N-20	Hwy 6/Coral Lea intersection (unserviced land)	500	500	0	500	0	500	0	193	193	0	193	0	193	0	193	0	203	10	239	46	24%	36
N-30	Egremont annexation lands (future unserviced land)	500	500	0	500	0	500	0	155	155	0	155	0	155	0	155	0	165	10	500	345	223%	335
N-34	Egremont annexation lands (future unserviced land)	291	291	-0	291	-0	291	0	155	155	0	155	0	155	0	155	0	163	8	291	136	88%	127
N-36	Egremont annexation lands (future unserviced land)	236	236	-0	236	-0	236	0	145	145	0	145	0	145	0	145	0	151	6	236	91	63%	85
N-50	Egremont annexation lands (future unserviced land)	451	451	0	445	-6	451	-0	160	160	0	160	0	160	0	160	0	171	11	431	272	170%	261
N-52	Egremont annexation lands (future unserviced land)	235	235	-0	234	-1	235	0	135	135	0	135	0	135	0	135	0	144	9	231	96	71%	87
N-54	Egremont annexation lands (future unserviced land)	227	227	-0	227	-1	227	0	135	135	0	135	0	135	0	135	0	144	9	225	90	67%	81
N-56	Egremont annexation lands (future unserviced land)	207	207	-0	207	-0	207	0	135	135	0	135	0	135	0	135	0	144	9	205	70	52%	61
N-60	Egremont annexation lands (future unserviced land)	266	266	-0	265	-1	266	0	149	149	0	149	0	149	0	149	0	158	9	262	113	76%	104
N-62	Egremont annexation lands (future unserviced land)	232	232	-0	231	-1	232	0	141	141	0	141	0	141	0	141	0	149	8	229	88	62%	79
N-64	Egremont annexation lands (future unserviced land)	187	187	-0	187	-0	187	0	128	128	0	127	0	128	0	128	0	135	7	186	58	45%	51
N-66	Egremont annexation lands (future unserviced land)	178	178	-0	178	-0	178	0	128	128	0	127	0	128	0	128	0	135	7	177	49	39%	42
N-80	Sligo/London Rd intersection (future unserviced land)	203	203	-0	195	-8	203	0	97	97	0	97	0	97	0	97	0	103	6	102	5	6%	-1
N-82	Sligo Road east of London Rd (future unserviced land)	119	119	-0	118	-2	119	0	80	80	0	80	0	80	0	80	0	85	5	83	3	4%	-2
N-84	Sligo Road east of London Rd (future unserviced land)	98	98	-0	97	-1	98	0	72	72	0	72	0	72	0	72	0	76	5	74	3	4%	-2
N-100	Queen/Ayrshire intersection (currently unserviced)	57	58	0	24	-34	58	-0	15	15	0	15	0	15	0	15	0	16	1	15	0	0%	-1
N-120	Ayrshire Street (currently unserviced)	50	50	0	23	-27	50	-0	15	15	0	15	0	15	0	15	0	16	1	15	0	0%	-1
N-122	SE of Murphy St (currently unserviced)	(N/A)	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	(N/A)	#VALUE!	(N/A)	####	(N/A)	####	(N/A)	####	(N/A)		(N/A)	#VALUE!	#VALUE!	#VALUE!
N-130	Glasgow St (currently unserviced)	54	54	1	33	-22	54	-0	17	17	0	17	0	17	0	17	0	19	1	18	0	0%	-1
N-400	Sunvale subdivision, Cork Street (future unserviced land)	93	111	18	111	-0	111	0	90	89	-1	89	-1	89	-1	89	-1	95	4	92	2	2%	-2
N-410	Sunvale subdivision, Cork Street (future unserviced land)	83	96	13	96	-0	96	0	81	80	-1	80	-1	80	-1	80	-1	85	4	83	2	2%	-2
N-420	Sunvale subdivision, Cork Street (future unserviced land)	83	95	13	95	-0	95	0	81	80	-1	80	-1	80	-1	80	-1	85	4	82	2	2%	-2
N-430	Sunvale subdivision, Cork Street (future unserviced land)	72	80	8	80	-0	80	0	70	69	-1	69	-1	69	-1	69	-1	74	3	71	1	2%	-2
N-440	Sunvale subdivision, Cork Street (future unserviced land)	69	77	8	77	-0	77	0	68	67	-1	67	-1	67	-1	67	-1	71	3	69	1	2%	-2
N-450	Sunvale subdivision, Cork Street (future unserviced land)	64	70	6	70	-0	70	0	63	62	-1	62	-1	62	-1	62	-1	66	3	64	1	1%	-2
N-460	Sunvale subdivision, Cork Street (future unserviced land)	64	70	6	70	-0	70	0	63	62	-1	62	-1	62	-1	62	-1	66	3	64	1	1%	-2
N-500	Sunvale subdivision, Cork Street (future unserviced land)	146	235	89	130	-105	234	-1	210	170	-40	90	-120	170	-40	164	-46	227	17	218	8	4%	-9

Elevated Tank #3 alternative

Junction	4-4	Run 4-4 minus Run 4-1		4-4b	Run 4-4b minus Run 4-4	4-4c	Run 4-4c minus Run 4-4b	Run 4-4c minus Run 4-4	Run 4-4b minus Run 4-1	4-5	Run 4-5 minus Run 4-4	4-6	Run 4-6 minus Run 4-5	4-7	Run 4-7 minus Run 4-6	4-8	Run 4-8 minus Run 4-5	4-9	5-1
J-10	288	96	43%	394	105	432	38	143	201	288	-0	290	2	290	0	288	0	288	426
J-20	250	13	4%	336	86	480	144	230	99	250	-0	252	2	252	0	250	0	250	413
J-30	256	30	10%	345	90	476	130	220	120	256	0	257	1	257	0	256	0	256	360
J-35	306	89	30%	483	177	500	17	194	267	306	0	306	0	306	0	306	0	306	375
J-40	240	32	11%	397	158	421	23	181	189	240	0	239	-1	239	0	240	0	240	377
J-50	192	-1	0%	373	182	500	127	308	180	192	0	191	-1	191	0	192	0	192	394
J-60	192	16	3%	412	220	500	88	308	236	192	0	191	-1	191	0	192	0	192	426
J-70	184	-21	-5%	305	121	412	107	228	100	184	0	183	-1	183	0	184	0	184	384
J-75	178	9	4%	229	51	245	16	67	60	178	0	179	0	178	0	178	0	178	384
J-80	146	7	4%	173	27	182	10	37	34	146	0	146	0	146	0	146	0	146	375
J-90	199	-52	-16%	260	61	374	114	175	9	199	-0	202	2	202	0	199	0	199	382
J-95	192	-59	-18%	250	58	358	109	167	-1	192	0	194	3	194	0	192	0	192	382
J-100	204	-52	-15%	271	67	373	102	169	15	204	0	205	1	205	0	204	0	204	388
J-105	176	-72	-24%	227	51	326	99	150	-20	176	-0	180	4	180	0	176	0	176	380
J-110	167	-111	-26%	225	57	298	74	131	-54	167	0	168	0	168	0	167	0	167	423
J-120	165	-84	-21%	223	58	295	72	130	-25	165	0	163	-1	163	0	165	0	165	394
J-125	163	-76	-22%	219	56	290	71	127	-20	163	0	161	-2	161	0	163	0	163	391
J-130	161	-68	-21%	215	54	285	69	123	-14	161	0	159	-2	159	0	161	0	161	387
J-135	35	1	2%	36	1	38	1	2	2	35	0	35	0	35	0	35	0	35	345
J-140	159	-53	-19%	211	52	265	54	106	-1	159	0	157	-2	157	0	159	0	159	384
J-150	158	-33	-14%	198	40	231	33	73	7	158	0	156	-2	156	0	158	0	158	376
J-160	101	-4	-3%	108	7	117	9	16	3	101	0	102	1	101	0	101	0	101	377
J-170	61	1	1%	63	1	65	3	4	2	61	0	61	0	61	0	61	0	61	384
J-180	118	-4	-3%	124	6	134	9	16	2	118	0	118	1	118	0	118	0	118	380
J-190	162	-97	-31%	206	44	293	87	131	-53	162	-0	166	5	166	0	162	0	162	376
J-200	44	1	2%	45	1	47	2	3	2	44	-0	44	0	44	0	44	0	44	355
J-210	114	-9	-7%	122	8	137	15	23	-1	114	-0	115	1	115	0	114	0	114	331
J-220	152	-162	-38%	194	41	255	61	103	-121	152	0	156	4	156	0	152	0	152	413
J-230	149	-157	-40%	188	39	247	58	97	-118	150	0	154	4	153	0	150	0	150	386
J-240	54	-0	0%	56	2	59	4	5	2	54	0	54	0	54	0	54	0	54	307
J-250	105	-7	-6%	113	8	122	9	17	1	105	0	155	50	155	0	105	0	105	374
J-260	88	-4	-4%	93	5	101	8	13	2	88	0	152	65	153	0	88	0	88	322
J-270	138	-84	-35%	168	30	213	45	75	-54	138	0	149	12	150	0	138	0	138	374
J-280	129	-12	-8%	140	11	153	13	25	-1	129	0	130	1	129	-1	129	0	129	371
J-290	100	-4	-4%	106	6	114	8	14	2	100	0	100	0	100	0	100	0	100	368
J-300	53	0	1%	55	1	57	2	4	2	53	0	53	0	53	0	53	0	53	382
J-310	134	-21	-13%	146	13	162	16	29	-9	134	0	137	3	136	-1	134	0	134	356
J-315	77	-4	-4%	81	3	86	6	9	-0	77	0	78	1	78	0	77	0	77	355
J-320	37	1	2%	38	1	39	1	2	1	37	0	37	0	37	0	37	0	37	404
J-330	53	1	2%	54	1	56	2	4	2	53	0	53	0	53	0	53	0	53	359
J-340	156	-50	-22%	196	41	225	29	69	-9	156	-0	160	5	160	0	156	0	156	356
J-350	155	-99	-33%	195	40	267	72	112	-59	155	-0	160	5	160	0	155	0	155	404

J-360	152	-26	-13%	169	17	188	18	36	-8	152	0	156	4	156	0	152	0	152	394
J-370	149	-172	-37%	188	38	246	58	97	-134	149	0	153	4	153	0	149	0	149	412
J-380	70	-3	-4%	73	3	77	5	7	-0	70	0	71	1	71	0	70	0	70	351
J-390	152	-120	-36%	191	38	255	64	102	-81	152	-0	157	5	157	0	152	0	152	406
J-400	117	-11	-8%	125	8	150	25	34	-3	117	0	118	1	118	0	117	0	117	339
J-410	116	-14	-10%	126	9	143	18	27	-5	117	0	118	1	118	0	117	0	117	324
J-420	147	-61	-26%	183	36	210	27	63	-25	147	0	152	4	152	0	147	0	147	356
J-430	145	-211	-45%	180	35	235	55	90	-176	145	0	150	5	150	0	145	0	145	412
J-440	142	-210	-46%	175	33	227	52	85	-177	142	0	147	5	147	0	142	0	142	373
J-450	137	-104	-40%	166	30	212	45	75	-74	137	0	146	9	146	0	137	0	137	386
J-460	135	-125	-41%	164	29	207	43	72	-97	135	0	145	9	146	1	135	0	135	374
J-470	135	-78	-34%	162	27	204	42	69	-51	135	0	145	9	145	1	135	0	135	370
J-480	148	-137	-41%	184	36	241	57	93	-102	148	-0	153	5	152	0	148	0	148	380
J-490	147	-142	-42%	182	35	238	56	91	-107	146	-0	151	5	151	0	146	0	146	366
J-500	146	-49	-23%	174	28	198	24	51	-21	146	-0	151	5	151	0	146	0	146	352
J-510	145	-74	-31%	178	34	213	34	68	-40	145	-0	149	5	149	0	145	0	145	381
J-520	142	-222	-45%	175	33	227	52	85	-189	142	0	147	5	147	0	142	0	142	412
J-530	140	-221	-44%	172	32	222	51	82	-189	140	0	145	5	145	0	140	0	140	399
J-540	132	-28	-17%	143	10	157	15	25	-18	132	0	135	3	140	5	132	0	132	380
J-550	132	-114	-42%	159	27	200	41	68	-87	132	0	140	8	141	2	132	0	132	335
J-560	97	-12	-11%	104	6	114	10	16	-6	98	0	100	3	100	0	98	0	98	331
J-570	86	-7	-8%	90	5	98	8	12	-3	86	0	88	2	87	0	86	0	86	336
J-580	41	0	0%	42	1	44	2	3	1	41	0	42	0	42	0	41	0	41	336
J-590	114	-19	-14%	122	9	135	13	22	-10	114	0	118	5	118	0	114	0	114	341
J-600	73	-4	-5%	77	3	82	6	9	-1	73	0	75	1	75	0	73	0	73	335
J-610	146	-145	-43%	180	34	235	55	90	-110	145	-0	150	5	150	0	145	0	145	366
J-620	143	-167	-44%	176	33	229	53	86	-134	143	0	148	5	148	0	143	0	143	411
J-630	142	-182	-45%	174	32	227	52	85	-150	142	0	147	5	147	0	142	0	142	413
J-640	140	-239	-49%	171	31	221	50	81	-208	140	0	145	5	145	0	140	0	140	386
J-650	140	-197	-50%	171	31	220	50	80	-166	140	0	145	5	145	0	140	0	140	374
J-660	138	-243	-49%	167	30	216	49	78	-214	138	0	143	5	143	0	138	0	138	358
J-670	111	-18	-14%	118	7	129	11	18	-11	111	0	112	2	141	29	111	0	111	366
J-680	129	-108	-42%	154	25	193	39	64	-83	129	0	136	7	138	2	129	0	129	351
J-690	29	0	2%	30	1	31	1	2	1	29	0	29	0	29	0	29	0	29	338
J-700	75	-5	-6%	79	4	85	7	10	-2	75	0	77	1	77	0	75	0	75	318
J-710	92	-11	-10%	98	6	107	9	15	-5	92	0	94	2	95	0	92	0	92	326
J-720	85	-12	-12%	91	6	102	11	18	-6	85	0	87	2	87	0	85	0	85	314
J-730	137	-218	-53%	167	29	215	48	77	-189	138	0	142	5	142	0	138	0	138	342
J-740	135	-237	-53%	163	28	210	47	75	-209	135	0	140	5	140	0	135	0	135	302
J-750	134	-279	-56%	162	27	208	46	73	-251	134	0	139	4	139	0	134	0	134	303
J-760	129	-202	-52%	154	25	195	41	66	-177	129	0	133	4	134	0	129	0	129	248
J-770	122	-107	-42%	143	21	178	35	57	-85	122	0	126	5	127	1	122	0	122	250
J-780	121	-87	-38%	142	21	176	34	55	-66	121	0	126	5	127	1	121	0	121	376
J-790	103	-36	-25%	115	13	137	22	34	-24	103	0	106	4	107	1	103	0	103	280
J-800	99	-32	-23%	111	12	131	20	32	-20	99	0	103	4	103	1	99	0	99	262
J-810	95	-27	-21%	106	11	125	18	29	-16	96	0	99	3	99	0	96	0	96	255
J-820	92	-23	-19%	102	10	119	17	27	-13	92	0	95	3	96	0	92	0	92	251
J-830	43	-0	-1%	44	1	47	3	4	1	43	0	43	0	43	0	43	0	43	298
J-840	78	-8	-9%	82	5	91	9	13	-4	78	0	79	1	79	0	78	0	78	290
J-850	78	-8	-10%	82	5	91	9	13	-4	78	0	79	1	79	0	78	0	78	288
J-860	119	-90	-39%	139	20	172	33	53	-71	119	0	123	5	124	1	119	0	119	275
J-870	62	-5	-7%	65	3	72	7	10	-1	62	0	63	1	63	0	62	0	62	298
J-890	152	-78	-31%	190	38	239	49	87	-40	152	0	157	5	157	0	152	0	152	415
J-900	139	-17	-11%	149	10	162	13	23	-8	146	7	147	1	147	0	146	0	146	406
J-910	143	-22	-13%	154	11	169	15	25	-11	145	2	150	5	150	0	145	0	145	401
J-920	144	-101	-36%	177	33	230	53	86	-68	144	-0	148	5	148	0	144	0	144	389
J-930	139	-64	-30%	163	24	184	22	45	-41	139	0	143	4	144	0	139	0	139	350
J-940	137	-63	-30%	154	17	175	22	39	-46	137	0	141	4	141	0	137	0	137	333
J-950	112	-32	-22%	121	9	136	15	24	-23	112	0	114	2	114	0	112	0	112	319
J-960	134	-356	-71%	160	27	205	44	71	-329	134	0	138	4	138	0	134	0	134	275
J-970	132	-368	-74%	157	25	199	43	67	-343	132	0	136	4	136	0	132	0	132	253

J-990	134	-303	-62%	161	27	205	44	71	-277	134	0	139	4	139	0	134	0	134	325
J-1000	134	-182	-55%	161	27	205	44	71	-156	134	0	139	4	139	0	134	0	134	339
J-1010	119	-91	-39%	139	20	172	33	53	-72	119	0	123	4	124	1	119	0	119	257
J-1020	21	1	4%	21	1	22	1	2	1	21	0	21	0	21	0	21	0	21	245
J-1030	22	1	3%	23	0	24	1	2	1	22	0	22	0	23	0	22	0	22	267
J-1040	27	1	3%	27	1	29	2	2	1	27	0	27	0	27	0	27	0	27	264
J-1050	110	-8	-7%	114	5	123	8	13	-3	116	7	117	1	117	0	116	0	116	406
J-1060	94	-5	-5%	97	3	103	6	9	-2	100	6	101	1	101	0	100	0	100	415
J-1070	78	-2	-3%	80	2	84	4	6	-0	82	4	82	0	82	0	82	0	82	410
J-1080	77	-2	-3%	79	2	84	5	7	-0	81	4	82	0	82	0	81	0	81	383
J-1090	84	-3	-3%	86	2	92	5	7	-1	89	4	89	0	89	0	89	0	89	410
J-1100	81	-3	-3%	84	2	89	5	7	-0	86	4	86	0	86	0	86	0	86	390
J-1110	102	-7	-6%	106	4	114	8	12	-3	111	10	112	1	112	0	111	0	111	386
J-1120	100	-7	-6%	104	4	113	8	13	-3	110	10	111	1	111	0	110	0	110	394
J-1130	85	-4	-4%	88	3	94	6	9	-1	91	6	92	1	92	0	91	0	91	370
J-1140	82	-3	-4%	85	3	91	6	9	-1	89	7	89	1	89	0	89	0	89	359
J-1150	94	-6	-6%	98	4	106	8	13	-2	105	11	106	1	106	0	105	0	105	345
J-1160	105	-11	-9%	111	6	123	11	18	-4	145	41	150	5	150	0	145	0	145	331
J-1170	64	-1	-1%	65	1	69	3	4	0	66	2	66	0	66	0	66	0	66	403
J-1180	98	-9	-8%	103	5	113	10	15	-3	110	12	111	1	111	0	110	0	110	327
J-1190	144	-71	-30%	178	33	209	31	65	-37	144	-0	149	5	149	0	144	0	144	369
J-1200	145	-51	-24%	169	24	194	25	49	-27	144	-1	149	5	149	0	144	0	144	366
J-1210	145	-33	-17%	160	15	179	19	34	-18	144	-1	149	5	149	0	144	0	144	366
J-1220	75	-3	-4%	78	3	84	5	8	-0	145	70	150	5	150	0	145	0	145	346
J-1230	109	-12	-10%	116	7	127	12	19	-5	145	37	150	5	150	0	145	0	145	333
J-1240	108	-18	-14%	114	6	124	10	16	-12	108	0	109	1	109	0	108	0	108	383
J-1250	135	-200	-55%	163	28	208	45	73	-172	135	0	140	4	140	0	135	0	136	381
J-1260	135	-224	-57%	162	27	207	45	72	-197	135	0	139	4	139	0	135	0	135	379
J-1270	135	-236	-59%	162	27	207	45	72	-209	135	0	139	4	139	0	135	0	135	342
J-1280	135	-112	-43%	157	23	186	29	51	-90	135	0	139	4	139	0	135	0	104	457
J-1290	135	-146	-49%	162	27	198	35	63	-118	135	0	139	4	139	0	135	0	135	476
J-1300	42	-0	-1%	42	1	44	1	2	0	42	0	42	0	42	0	42	0	42	437
J-1310	134	-103	-42%	155	21	184	28	49	-82	134	0	139	4	139	0	130	-4	110	437
J-1315	133	-83	-37%	149	16	175	26	42	-66	133	0	136	3	136	0	125	-8	101	378
J-1320	21	0	2%	22	0	22	1	1	1	21	0	21	0	21	0	21	0	21	386
J-1330	19	0	2%	19	0	20	1	1	1	19	0	19	0	19	0	19	0	19	332
J-1340	133	-367	-73%	158	25	201	43	68	-342	133	0	137	4	137	0	133	0	133	267
J-1790	105	-7	-6%	110	4	117	8	12	-2	111	6	112	1	112	0	111	0	111	417
J-1800	150	-16	-8%	172	22	197	25	47	7	150	0	153	4	152	-1	150	0	150	322
J-1810	103	-6	-5%	107	4	114	7	11	-2	109	5	109	1	109	0	109	0	108	432
J-1820	93	-4	-4%	96	3	102	6	9	-1	97	4	97	0	97	0	97	0	97	422
J-1830	89	-3	-4%	91	3	97	5	8	-1	92	3	93	0	93	0	92	0	92	419
J-1840	93	-22	-19%	103	10	119	15	25	-12	93	0	96	3	97	0	93	0	93	282
J-1850	75	-6	-7%	78	4	85	7	11	-2	75	0	76	1	76	0	75	0	75	307
J-1860	86	-13	-12%	92	7	104	12	18	-6	86	0	88	2	88	0	86	0	86	326
J-1870	75	-7	-9%	80	5	89	9	14	-3	75	0	77	2	77	0	75	0	75	277
J-1880	81	-10	-11%	86	6	97	10	16	-4	81	0	83	2	83	0	81	0	81	277
J-1890	89	-13	-12%	96	6	106	11	17	-6	89	0	91	2	92	0	89	0	89	297
J-1900	54	-1	-1%	55	1	57	2	4	1	54	0	54	1	54	0	54	0	54	393
J-1910	500	297	116%	500	0	500	0	0	297	500	0	500	0	500	0	500	0	500	426
J-1920	184	18	4%	438	255	468	30	284	272	184	0	184	0	184	0	184	0	184	439
J-1930	135	-44	-23%	160	24	178	18	43	-20	135	0	145	9	145	1	135	0	135	373
J-1940	34	0	1%	35	0	36	1	1	1	35	0	35	0	35	0	35	0	35	426
JN-67	(N/A)	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)
JN-68	(N/A)	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)
JN-69	(N/A)	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)
JN-200	72	-3	-4%	75	3	79	5	8	-0	72	0	73	1	73	0	72	0	72	357
JN-205	65	-2	-3%	67	2	71	4	6	0	65	0	66	1	65	0	65	0	65	355
JN-210	72	-3	-4%	75	3	80	5	8	-0	72	0	73	1	73	0	72	0	72	362
JN-215	72	-3	-4%	75	3	80	5	8	-0	72	0	73	1	73	0	72	0	72	367
JN-220	70	-3	-4%	73	3	78	5	7	-0	70	0	71	1	71	0	70	0	70	367

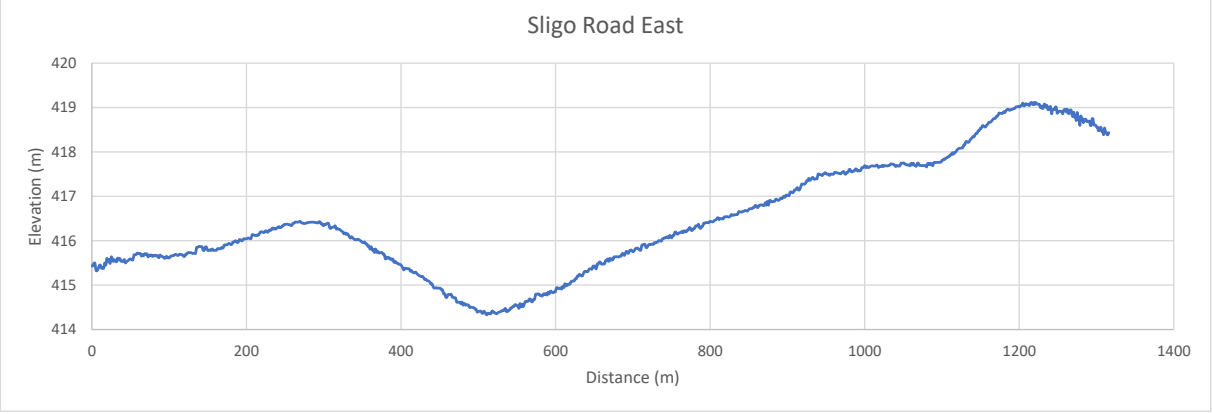
JN-225	135	-94	-39%	152	17	179	27	44	-76	135	0	138	3	138	0	130	-5	89	378
JN-230	133	-88	-38%	150	17	176	26	43	-72	133	0	136	3	136	0	128	-5	85	373
JN-235	123	-35	-22%	132	9	146	14	23	-26	123	0	124	2	124	0	114	-8	84	364
JN-240	125	-36	-22%	134	9	149	14	24	-26	125	0	127	2	127	0	117	-8	84	372
JN-245	121	-34	-22%	130	9	144	14	23	-25	121	0	122	2	122	0	113	-8	81	359
JN-250	123	-35	-22%	132	9	146	14	23	-26	123	0	125	2	125	0	115	-8	80	366
JN-255	130	-77	-36%	145	15	169	25	40	-62	130	0	132	3	132	0	124	-6	79	353
JN-260	128	-73	-35%	143	15	167	24	39	-58	128	0	130	3	130	0	122	-6	76	360
JN-265	127	-71	-35%	141	15	165	23	38	-56	127	0	129	2	129	0	120	-7	74	355
JN-270	112	-29	-20%	120	8	134	13	21	-21	112	0	114	1	114	0	106	-6	74	347
JN-275	80	-10	-10%	84	4	91	7	11	-6	80	0	81	1	81	0	113	32	73	339
JN-280	126	-69	-34%	140	14	163	23	37	-54	126	0	129	2	129	0	119	-7	73	350
JN-285	119	-38	-24%	129	10	145	16	26	-28	119	0	121	2	121	0	112	-7	72	337
JN-290	124	-64	-33%	138	14	160	22	36	-50	124	0	126	2	126	0	116	-8	70	319
JN-295	123	-62	-32%	136	13	158	22	35	-48	123	0	125	2	125	0	114	-9	86	301
JN-310	106	-3	-3%	112	6	121	9	14	2	106	0	107	1	107	0	106	0	106	357
JN-315	155	-100	-33%	196	40	269	73	113	-60	155	-0	160	5	160	0	155	0	155	402
JN-320	153	-84	-32%	191	39	248	57	95	-45	153	0	158	5	158	0	153	0	153	404
JN-325	97	-7	-6%	101	4	109	8	12	-2	107	11	108	1	108	0	107	0	107	360
JN-330	90	-5	-5%	94	4	101	7	11	-1	98	8	99	1	99	0	98	0	98	354
JN-335	94	-24	-20%	104	10	121	18	28	-14	94	0	97	3	97	0	94	0	94	253
JN-340	84	-13	-13%	90	7	102	12	19	-6	84	0	86	2	86	0	84	0	84	265
JN-345	72	-6	-8%	77	4	85	8	12	-2	72	0	74	1	74	0	72	0	72	279
JN-350	59	-3	-4%	62	3	67	6	8	0	59	0	60	1	60	0	59	0	59	277
JN-355	85	-8	-9%	90	5	98	8	13	-3	85	0	87	2	87	0	85	0	85	321
JN-360	93	-21	-18%	102	9	118	16	25	-12	93	0	96	3	96	0	93	0	93	263
JN-365	93	-22	-18%	103	10	118	15	25	-12	93	0	96	3	97	0	93	0	93	276
N-10	357	196	110%	420	63	435	15	78	260	357	-0	359	2	359	0	357	0	357	422
N-20	500	307	129%	500	0	500	0	0	307	500	0	500	0	500	0	500	0	500	407
N-30	169	14	3%	500	331	500	0	331	345	169	0	169	0	169	0	169	0	169	349
N-34	166	11	4%	266	100	272	5	106	111	166	0	166	0	166	0	166	0	166	458
N-36	153	8	3%	224	71	228	4	75	79	153	0	153	0	153	0	153	0	153	453
N-50	176	16	4%	369	193	390	21	214	209	176	0	176	0	176	0	176	0	176	433
N-52	146	11	5%	225	79	234	9	88	90	146	0	146	0	146	0	146	0	146	339
N-54	146	11	5%	221	75	227	6	81	86	146	0	146	0	146	0	146	0	146	423
N-56	146	11	5%	204	57	209	5	63	69	146	0	146	0	146	0	146	0	146	433
N-60	161	12	5%	252	91	261	9	100	103	161	0	161	0	161	0	161	0	161	414
N-62	152	11	5%	224	72	231	8	80	83	152	0	152	0	152	0	152	0	152	404
N-64	136	9	5%	185	49	191	6	54	57	136	0	136	0	136	0	136	0	136	370
N-66	136	9	5%	177	41	181	4	45	50	136	0	136	0	136	0	136	0	136	438
N-80	94	-3	-2%	100	6	108	8	14	3	94	0	95	1	95	0	94	0	94	384
N-82	79	-1	-1%	83	4	88	6	10	3	79	0	79	0	79	0	79	0	79	359
N-84	71	-0	0%	75	3	79	5	8	3	71	0	72	0	72	0	71	0	71	346
N-100	16	0	2%	16	0	16	0	1	1	16	0	16	0	16	0	16	0	16	429
N-120	16	0	3%	16	0	16	0	1	1	16	0	16	0	16	0	16	0	16	351
N-122	(N/A)	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	#VALUE!	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	#VALUE!	(N/A)	
N-130	18	0	2%	18	0	19	1	1	1	18	0	18	0	18	0	18	0	18	346
N-400	87	-3	-4%	89	2	94	5	8	-1	92	5	92	0	92	0	92	0	92	413
N-410	79	-2	-3%	80	2	85	4	6	-1	82	4	83	0	83	0	82	0	82	412
N-420	78	-2	-3%	80	2	84	4	6	-1	82	4	82	0	82	0	82	0	82	412
N-430	69	-1	-2%	70	1	74	3	5	-0	71	2	72	0	72	0	71	0	71	411
N-440	67	-1	-2%	68	1	71	3	4	-0	69	2	70	0	70	0	69	0	69	411
N-450	62	-1	-1%	63	1	66	3	4	0	64	2	64	0	64	0	64	0	64	411
N-460	62	-1	-1%	63	1	66	3	4	0	64	2	64	0	64	0	64	0	64	411
N-500	130	-80	-36%	146	16	171	25	40	-64	130	0	133	3	133	0	125	-6	80	357
																		Min:	245
																		Max:	476

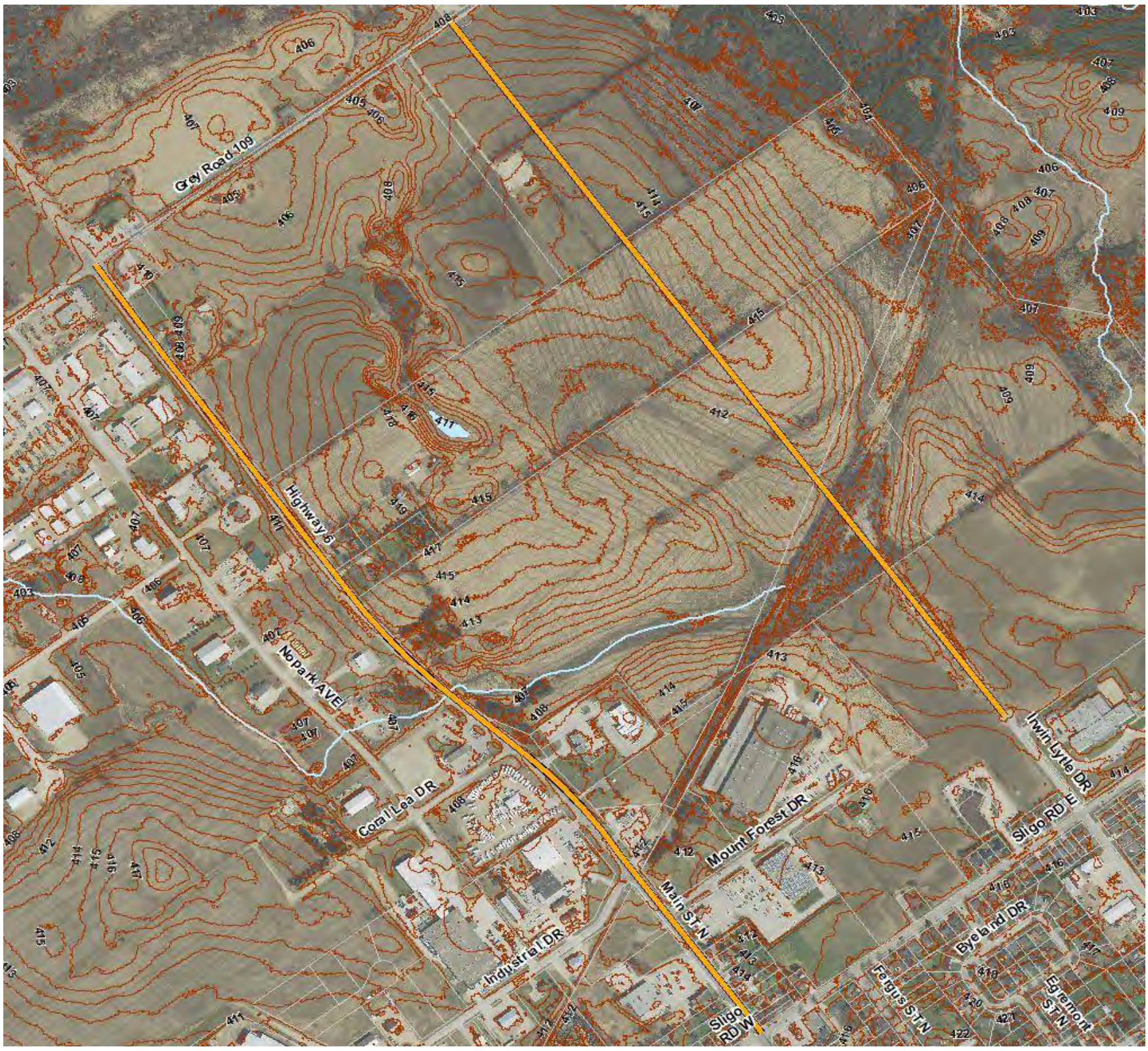
APPENDIX G
WATERMAIN BREAKAGE SUMMARY
(2004 to mid-2020)

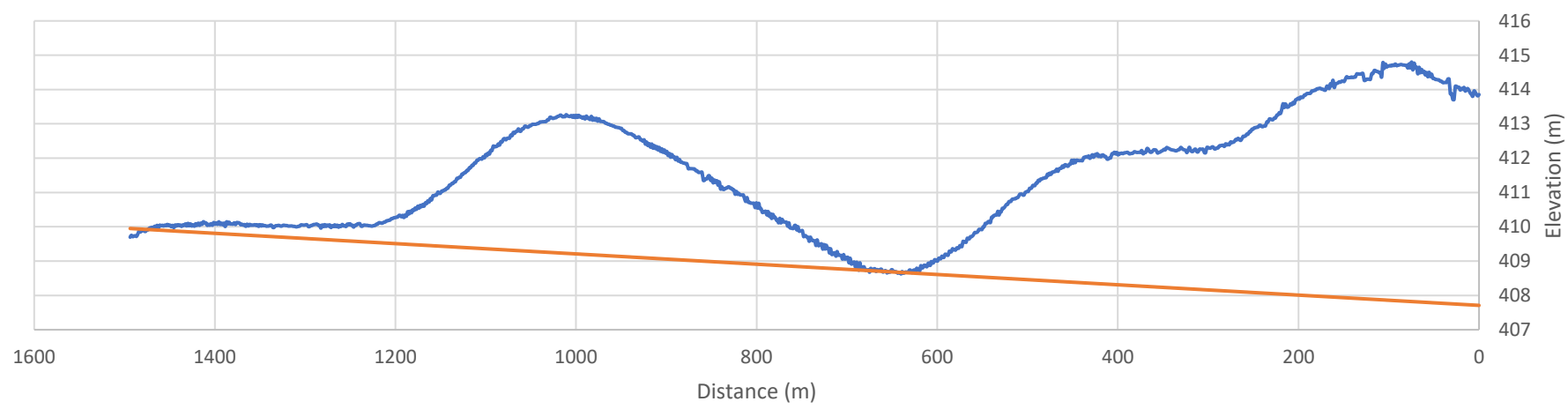
Street	From	To	Size(mm Dia)	Size (inches)	Material	Date of break	Depth of main (m)	Depth of main(Inches)	Type of break	Exterior condition	Interior condition	Cause (As per operator)	Repair made	Other comments
James St.	Queen St.	Waterloo St.	100.0	4		18-Nov-04	1.676	66	Ring			Deterioration	100mm repair clamp on ring break, back filled with new material	
Elgin St.		Corner of Durham St.	250.0	10	CI	28-Dec-04	1.676	66	Ring				Put 250mm Sleeve on fractured main, superchlorinated parts. Backfilled with crushed stone and gravel	
Grant St.	Parkside Dr.	Main St. S	250.0	10		16-Dec-04	1.829	72	Joint			Deterioration	3' pipe cut out + replaced with new 250mm watermain connected with 2 250mm Maxi fit couplings, superchlorinated main.	
North water St.	John St.	James St.	150.0	6		02-Sep-04	1.829	72	Ring			Stress	Chlorinated 150mm repair clamp and water main installey clamp and changed line	
Fergus St.	Birmingham St.	Wellington St.	100.0	4	CI	22-Apr-05	1.829	72	Ring			Deterioration	100mm was installed after main was cleaned. Backfill with crush + gravel.	
Main St.	Grant St.	Miller St.	100.0	4	CI	18-Feb-05	0.991	39	Blowout			Deterioration	100mm reapair clamp installed, vales turned back on.	
James St.	Waterloo St.	North Water St.	150.0	6	CI	22-Jan-05	1.600	63	Ring			Stress	Dug out and installed 150mm repair clamp	
Wellington St.	Egremont St.	Church St.	150.0	6	CI	08-Jan-08	1.524	60	Ring			Deterioration	150mm stainless steel clamp was installed around break	
Sligo Rd.	Perth St.	Foster St.	250.0	10	CI	19-Mar-08	1.829	72	Ring			Stress	250mm repair clamp was installed	
Birmingham St.		NW corner of Normanby St	150.0	6	CI	20-May-08	1.295	51	Boring by Pikards			Contractor	150mm stainless steel clamp was installed around break	
Church St.		church and Durham intersection	150.0	6		08-Dec-08	1.981	78	Ring			Stress	150mm repair clamp was installed around break	
Wellington St.		Wellington and Elgin intersection	250.0	10	PVC	30-Sep-08	1.829	72	Accidental			Contractor	250mm Maxifit coupler, 300mm mechanical joint + accessories	
Main St.	Wellington St.	King St.	200.0	8	DI	16-Apr-09			Ring			Deterioration	200mm stainless steel repair clamp was installed	
Wellington St.	Church St.	London St.	150.0	6	CI	12-Mar-09	1.676	66	Ring			Deterioration	150mm repair clamp was installed	
Wellington St.	Church St.	London St.	150.0	6	CI	12-Mar-09	0.000		Ring				150mm stainless steel repair clamp	
James St.	Waterloo St.	North Water St.	100.0	4	CI	17-Jan-09	1.524	60	Ring			Frost pressure	100mm repair clamp installed	
Main St.		Birmingham and Main intersection	200.0	8	CI	27-Apr-09			Ring				200mm stainless steel repair clamp	
Church St.	Durham St.	Birmingham St.	150.0	6	DI	24-Sep-11	1.829	72	Ring			Deterioration	150mm stainless steel repair clamp	
Foster St.	Sligo Rd.	Durham St.	250.0	10	PVC	27-Apr-11	1.676	66	Main hit by construction			Xterra	Cut out 2m length in pipe and installed new PVC pipe and Maxifit + Hymax coulpings	
Queen St.		Queen and Arthur intersection	250.0	10	CI	22-Feb-12	1.676	66	Ring			Deterioration	300mm stainless steel repair clamp was used along with rubber taken from a 250mm stainless repair clamp	250mm stainless steel repair clamp wasnt holding so used a 300mm stainless repair clamp and the rubber from the 250mm repair clamp
Albert St.	Egremont St.	Church St.	250.0	10	DI	28-Jun-13	2.896	114	Blowout			Unknown	Repaired Blowout with 250mm Repair clamp	First 250mm repair clamp didn't tighten up to seal the blowout. Picked up a 250mm repair clamp from Minto township
Durham St.		Durham and Church intersection	150.0	6	CI	24-Dec-13	1.829	72	Ring & Longitudinal			Stress	150mm repair clamp was installed	
Dublin St.	Princess St.	Martin St.	150.0	6	CI	01-Nov-13	1.524	60	Ring			Deterioration	Fixed under pressure using a 150mm stainless steel repair clamp	
James St.	Waterloo St.	North Water St.	150.0	6	CI	28-Oct-13	1.676	66	Ring			Deterioration	150mm stainless steel repair clamp was installed	
Princess ann St.	Dublin St.	Arthur St.	150.0	6	CI	31-Dec-13	1.219	48	Ring			Deterioration	150mm Stainless steel repair clamp was installed	
Wellington St.	Church St.	London St.	150.0	6	CI	20-Nov-13	1.524	60	Ring			Unknown	150mm Srainless steel repair clamp was installed	
James St.	Queen St.	Waterloo St.	100.0	4	CI	12-Mar-15	1.829	72	Ring			Age	100mm Repair clamp was installed	
Church St.	Durham St.	Birmingham St.	150.0	6	CI	06-Jan-15	1.524	60	Ring			Deterioration	150mm stainless steel repair clamp was installed	
Murphy St.	Main St.	Glasgow St.	250.0	10	PVC	03-Mar-15	1.829	72	Gasket blown out at joint			Deterioration	"T" removed + replaced with 32" of blue brute, used existing 250mm to 150mm reducer	Upon arrival potable water running down bank into Saugeen River, placed dechlorination pucks in stream of water going into river. Minimized flow, took CL2 residue at river bank at approx 0900. Free CL2 0.05 mgl was highest DPD value. Melissa reported as a spill to MoECC. Due to watermain being dewatered for repair a precautionary BWA was issued by the MOH for Murphy St.
Perth St.		Across from Well #6	250.0	10	DI	24-Sep-16	2.591	102	Ring				250mm repair clamp was installed	Due to the amount of water + soil conditions Well 6 valve was closed + pump shutoff. Perth St. Was closed at both valves, MOH MoECC advised boil water notice.
Wellington St.	Egremont St.	Church St.	150.0	6	DI	03-Nov-17	1.321	52	Ring	Good	N/A		Stainless steel repair clamp	
Birmingham St.	Queen St.	Weber St.	150.0	6	CI	21-Jan-17	1.321	52	Ring	Ok	N/A		Stainless steel repair clamp	
Peel St.	Queen St.	York St.	100.0	4	CI	27-Mar-18	1.524	60	Ring	Good	N/A		Stainless steel repair clamp	
Durham St.		Durham and Perth intersection	250.0	10	DI	02-Feb-19	2.032	80	Split pipe	Good	Good		Removed 8' of 250mm Ductile iron watermain and installed 8' of 250mm PVC watermain using 250mm Hymax couplings.	CAD welded tracer wire on both Ductile watermain ends
Wellington St.	Dublin St.	Normanby St.	150.0	6	CI	10-Nov-19	1.524	60	Ring	Good	Unknown		Stainless steel repair clamp	
Arthur St.		Arthur and Queen intersection	250.0	10	DI	28-Aug-19	1.676	66	Joint Failure	Good	Good	250mm end cap rusted off "Y" connection	250mm end plug + rubber gasket bolts	Excavation was 12' x 12'. Asphalt was lifted in entire intersection and will have to be removed + repaved
King St.		King and Fergus intersection	100.0	4	CI	15-Nov-19	1.549	61	Ring	Good	N/A		Stainless steel repair clamp	slow seep and entering a catch basin talked to cory. Decided to repair Sat nov 16/19 in Daylight, to be on the safe side . Placed dechlorination pucks in catch basin
Queen St.	Main St.	Parkside Dr.	100.0	4	CI	31-Mar-20	1.499	59	Ring	Good	Good		Stainless steel repair clamp	

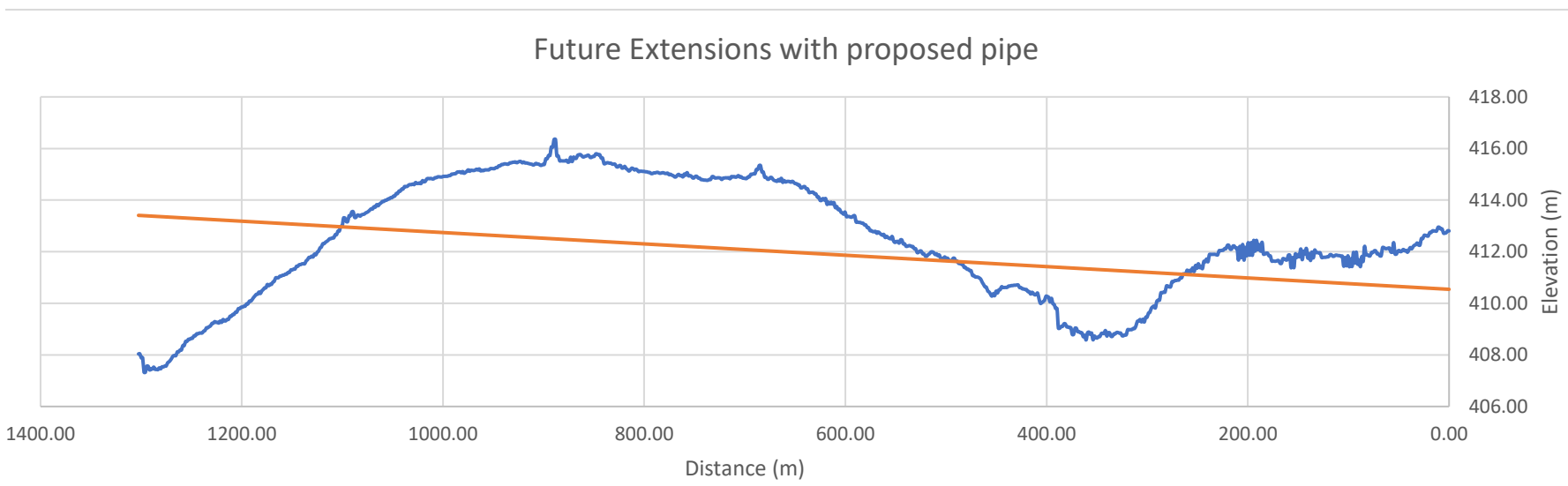
APPENDIX H
CONCEPTUAL SANITARY SEWER EXTENSION PROFILES

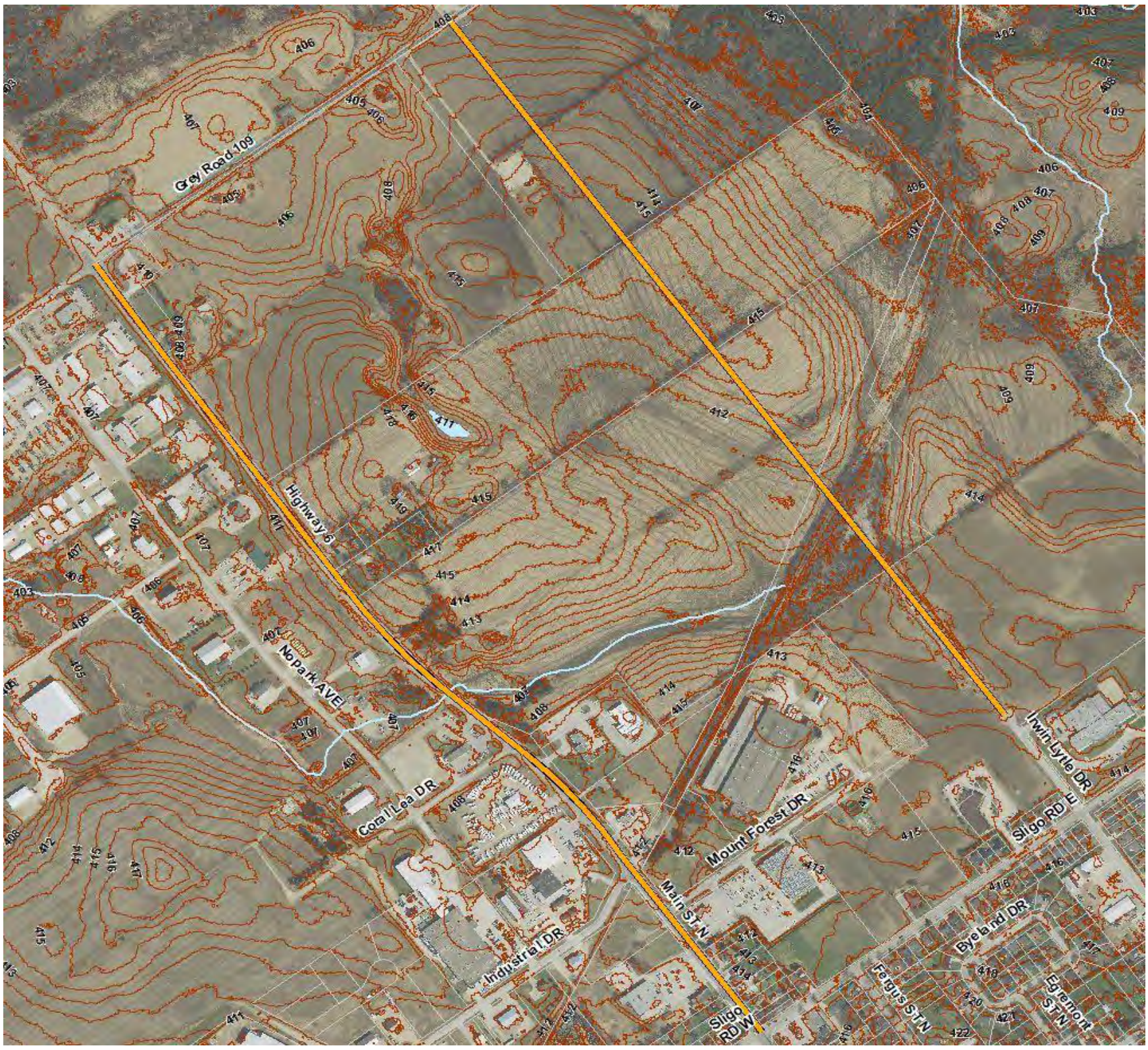

Bottom elevation of stream = 411.9m
Southgate Road 04
Southgate Sideroad 41
Sligo RD E
London RD N
Durham ST E
Cheryl Lynn ST
Wendy's LN
Church ST N
Irwin Lyte DR

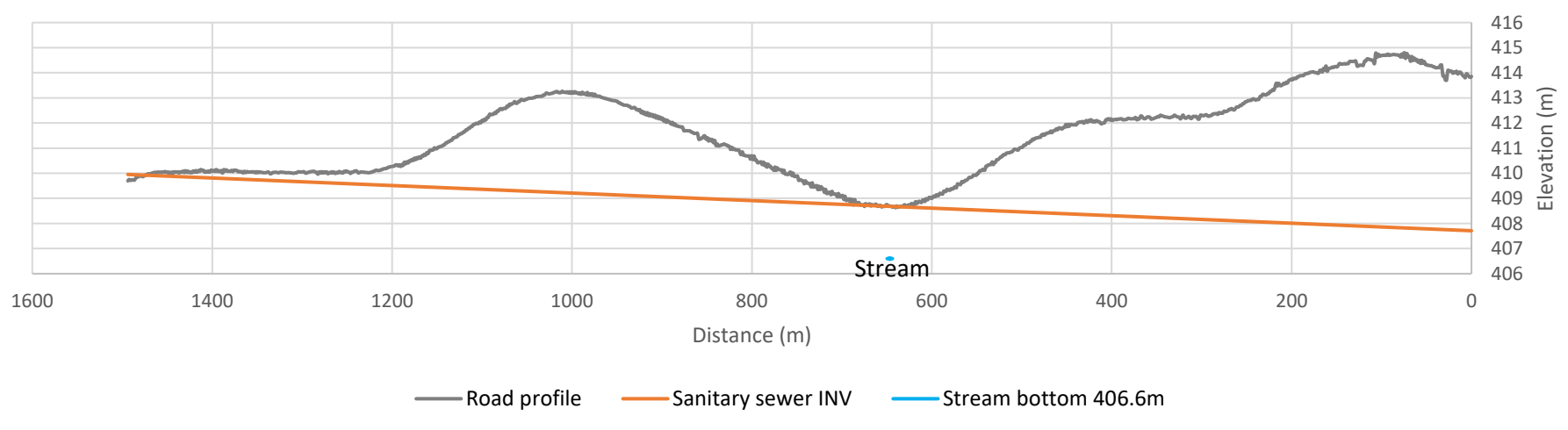

Sligo Road East
Elevation (m)
Distance (m)
420
419
418
417
416
415
414
0
200
400
600
800
1000
1200
1400

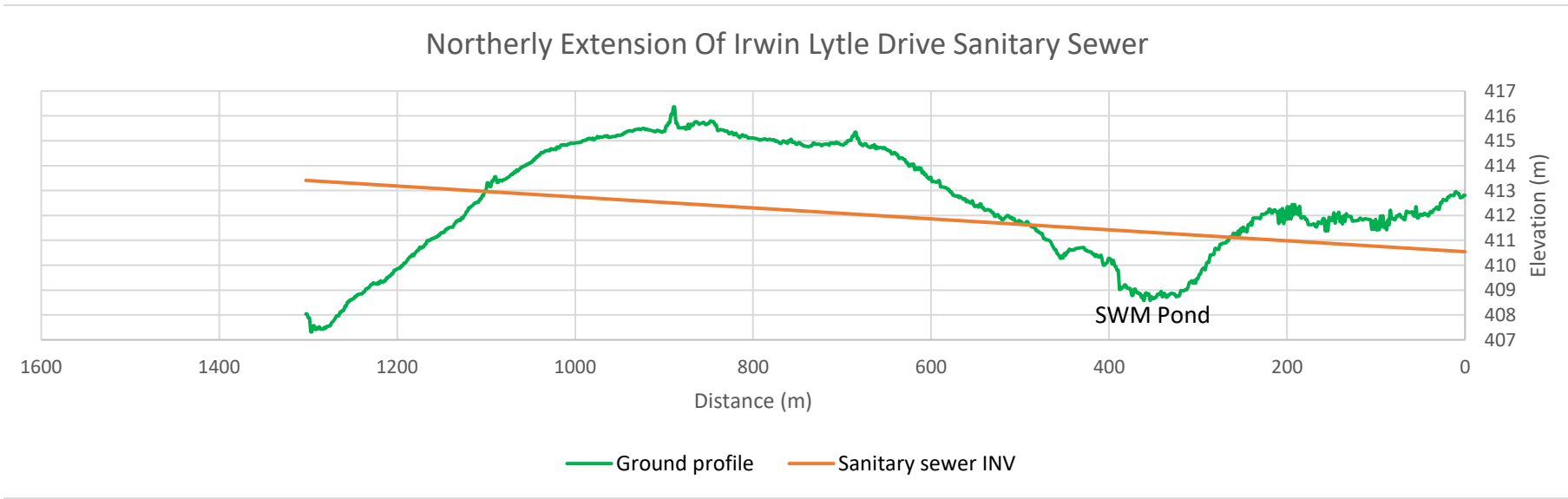

Grey Road 109
Highway 6
No Park AVE
Coral Lea DR
Industrial DR
Main ST N
Mount Forest DR
Sligo RD E
Irwin Lytle DR
Byeland DR
Fergus ST N
Egremont ST N
Sligo RD W


Highway 6 with proposed pipe
Elevation (m)
416
415
414
413
412
411
410
409
408
407
1600
1400
1200
1000
800
600
400
200
0
Distance (m)


Future Extensions with proposed pipe
Elevation (m)
418.00
416.00
414.00
412.00
410.00
408.00
406.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
Distance (m)







The above two figures indicates gravity sewer servicing for the future serviced Industrial Area within the former Egremont Annexation will not be feasible. A Sewage Pumping Station is required for sanitary servicing, due to stream crossing.

APPENDIX I
SPS INFORMATION

Ministry of the Environment | Ministère de l'Environnement

Ontario

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 6134-73FHHU
Issue Date: June 19, 2007

The Corporation of the Township of Wellington North
PO Box 125, 7490 Sideroad 7 West
Kenilworth, Ontario
N0G 2E0

Site Location: Mount Forest Wastewater Treatment Plant
(New Plant) (Old Plant)
651 Cork Street, Mount Forest 400 North Water Street, Mount Forest
Wellington North Township Wellington North Township
County of Wellington County of Wellington
N0G 2E0 N0G 2L3

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

the establishment of Mount Forest Wastewater Treatment Plant (new plant) at the 651 Cork Street location and modifications to the existing plant (old plant) at 400 North Water Street location for the collection, transmission, treatment and disposal of domestic sewage at a *Rated Capacity* of 2,818 m^3/d and *Peak Flow Rate* of 15,000 m^3/d serving the community of Mount Forest in the Township of Wellington North and consisting of the following *Works*:

PROPOSED WORKS

The following *Proposed Works* are to be installed/constructed at the above-noted site location for the new Mount Forest Wastewater Treatment Plant (new plant), unless otherwise indicated.

1. Raw Sewage Pumping Station

A raw sewage pumping station at the old plant at 400 North Water Street providing a firm capacity of 173.6 L/s peak flow and consisting of:

- two (2) raw sewage pumps with a capacity of 173.6 L/s at 44.2 m TDH and one (1) raw sewage pump with a capacity of 60 L/s at 17.7 m TDH;
- one (1) 16,000 L surge vessel;
- one (1) flow metering chamber located at the old plant at 400 North Water Street; and
- approximately 1,300 m of 300 mm diameter and 25 m of 250 mm diameter forcemain from the raw sewage pumping station to the new Influent Works building.

2. Influent Works

- an Influent Works building housing a vertical bar screen, a washer screw compactor, a circular grit chamber complete with grit extraction equipment and blowers, and a grit dewatering screw all sized to accommodate the hydraulic peak flow rate of 15,000 m^3/d together with connection of the sewage forcemain to the new Influent Works building;
- a separated room within the Influent Works building housing an alum storage facility including an alum storage tank with a capacity of 30,000 L including access cover and fill connection, overflow and level indicator together with two (2) chemical metering pumps, each with a minimum rated capacity of 17 L/hr, and

Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 1899-873P7E
Issue Date: July 23, 2010

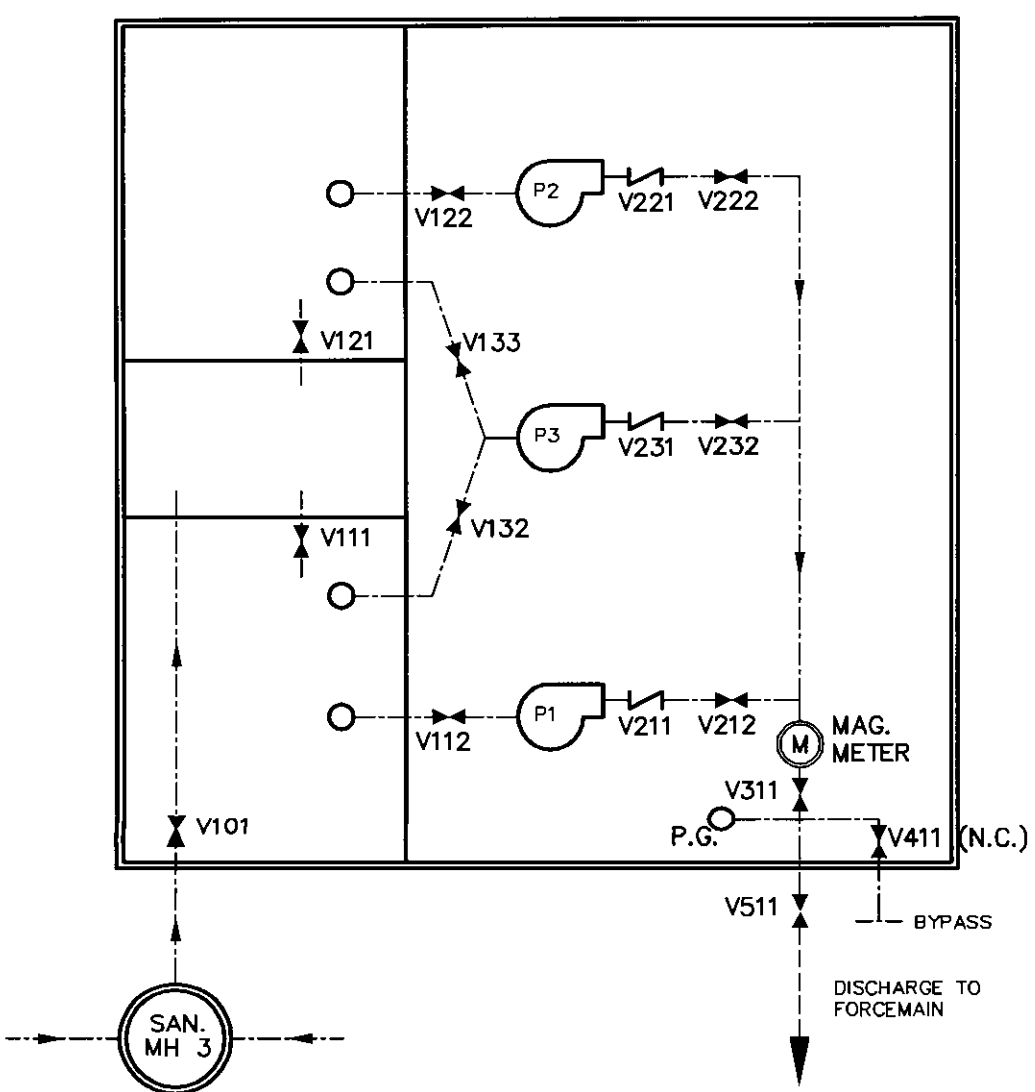
The Corporation of the Township of Wellington North
7490 Sideroad 7 W P.O. Box 125
Wellington North, Ontario
N0G 2E0

Site Location: Durham Street Sewage Pumping Station
191 Durham Street West
Intersection of Durham Street West and Foster Street, Community of Mount Forest
Township of Wellington North, County of Wellington

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

storm sewers, sanitary sewers, a sanitary sewage pumping station, and forcemain to be constructed to service Community of Mount Forest, with a sanitary drainage area of 346ha, having a 20 year Design Flow of 74 L/sec, 50 year Peak Design Flow of 166 L/sec and Ultimate Peak Design Flow of 251 L/sec, comprising the following:

- ***extend existing 250mm diameter sanitary sewers*** to maintenance hole MH3;
- ***new 600mm diameter sanitary sewer*** from MH3 to the proposed sanitary sewage pumping station;
- ***new 300mm diameter overflow sewer*** to storm sewer MH5;
- ***one (1) sanitary sewage pumping station,*** in a wet well/dry pit configuration, located at northeast corner of Durham Street and Foster Street intersection, consisting of a divided wet well having two (2) 2.8m x 3.2m cells and a 2.8m x 1.0m cell, designed to handle a ultimate period peak flow rate of 251 L/s, equipped with three (3) pumps, each rated to handle a 20 year flow of 74 L/sec at a Total Dynamic Head of 13m, complete with electrical and electronic control systems, an ultrasonic level transmitter, with back-up float switches connected to a PLC based control and monitoring system, discharge piping, ventilation system, valves, overflow pipe to an adjacent storm manhole, a 60 kW standby generator set, and all other appurtenances necessary to have a complete and operable pumping station, discharging to the proposed 300mm diameter forcemain;



SCHEMATIC LEGEND

- P1 — SUBMERSIBLE SEWAGE PUMP
- V221 — GATE OR KNIFE GATE VALVE
- V211 — CHECK VALVE
- M — FLOW METER
- 200 — PRESSURE PIPE AND DIAMETER
- 400 — GRAVITY PIPE AND DIAMETER

BMROSS engineering better communities

Township of Wellington North
Durham Street Sewage Pumping Station

Sewage Pumping Station
Process Schematic

CONTRACT No.	PROJECT No.
1	09094
SCALE	FIGURE
N.T.S.	1.1

Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
MUNICIPAL AND PRIVATE SEWAGE WORKS
NUMBER 8755-7WZKNW
Issue Date: November 5, 2009

The Corporation of the Township of Wellington-North
7490 Sideroad 7 West
Post Office Box, No. 125
Wellington-North, Ontario
N0G 2E0

Site Location: Cork Street Sewage Pumping Station
Township of Wellington-North, County of Wellington

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

a sanitary sewage pumping station to be constructed to service the west portion of the community of Mount Forest , in the Township of Wellington-North, County of Wellington, comprising the following:

- one (1) ***sanitary sewage pumping station*** located at the southwest corner of the intersection of Cork Street and Waterloo Street, in the community of Mount Forest, consisting of a 8.0 m x 3.6 m x 8.3 m (depth) wet well equipped with two (2) submersible pumps, one for duty and one for standby, each pump has a rated capacity of 67 L/s at a total dynamic head of 24.3 m, complete with electrical and electronic control systems, an ultrasonic level transmitter with back-up float switches connected by SCADA to the sewage treatment plant, discharge piping, ventilation system, valves, a 175 kW standby diesel generator set, and all other appurtenances necessary to have a complete and operable pumping station;

all in accordance with the application dated August 25, 2009 and received on October 15, 2009, and all supporting documentation and information including a design brief (or report), final plans and specifications prepared by B.M. Ross and Associates Limited.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

1. "*Act* " means the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended;

2. "*Certificate* " means this entire certificate of approval document, issued in accordance with Section 53 of the *Act* , and includes any schedules;

SCHEMATIC LEGEND

SP1 — SUBMERSIBLE SEWAGE PUMP

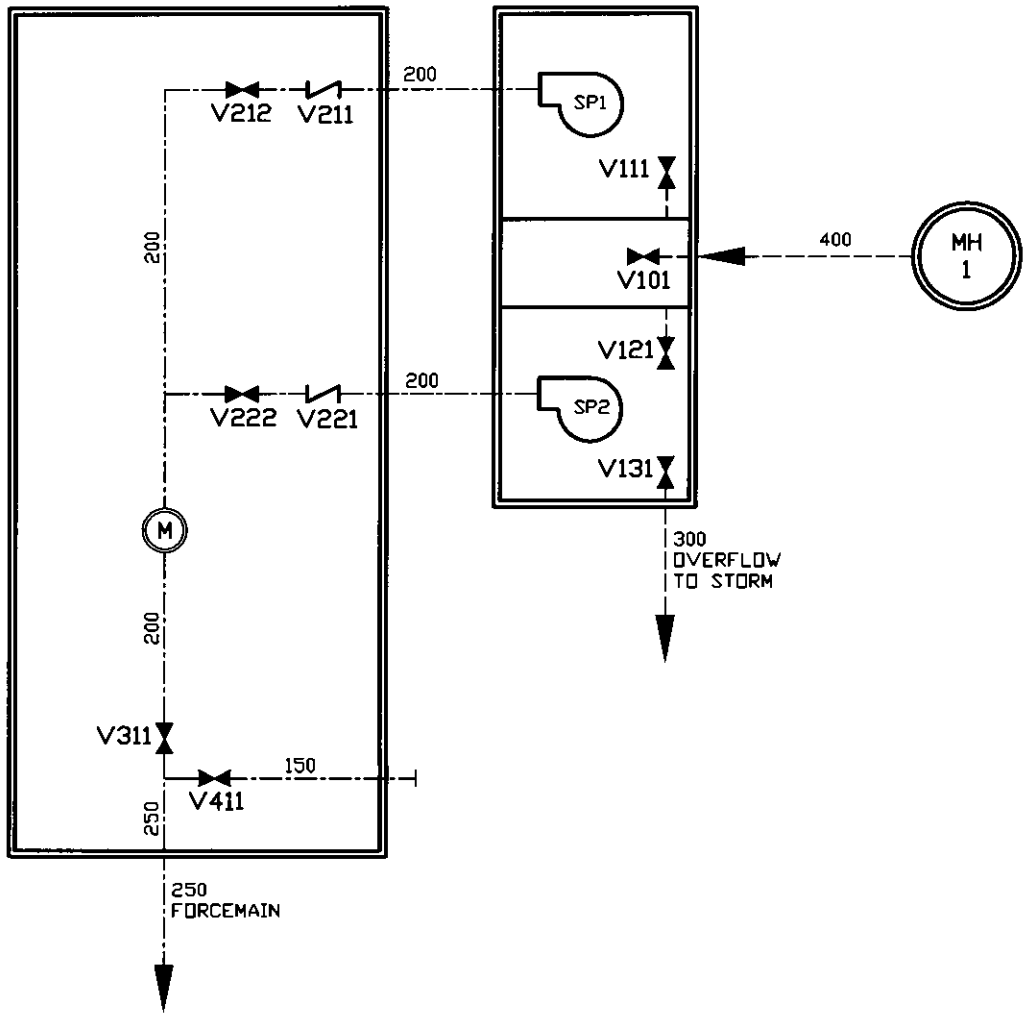
V221 — GATE OR KNIFE GATE VALVE

V211 — CHECK VALVE

M — FLOW METER

200 — PRESSURE PIPE AND DIAMETER

400 — GRAVITY PIPE AND DIAMETER



BMROSS engineering better communities

Township of Wellington North
Cork Street Sewage Pumping Station

Sewage Pumping Station
Process Schematic

CONTRACT No.	PROJECT No.
1	09106
SCALE	FIGURE
N.T.S.	1.1

Ministry of the Environment / Ministère de l'Environnement

Ontario

CERTIFICATE OF APPROVAL
SEWAGE
NUMBER 3-1843-98-996

Town of Mount Forest
102 Main Street
Mount Forest, Ontario
N0G 2L0

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

sanitary sewers and appurtenances to be installed on Perth Street, in the Town of Mount Forest, County of Wellington, as follows:

STREET	**FROM**	**TO**
Perth Street	SPS at Industrial Drive	Approx. 132 m North of Industrial Drive

including service connections, manholes and all other items necessary to have a complete and operable sanitary sewage collection system;

SEWAGE PUMPING STATION

a 1.8 m diameter x 5.1 m deep sanitary sewage pumping station, equipped with two (2) submersible sewage grinder pumps each capable of handling 3. 3 L/s against a total dynamic head of 35 m complete with access over, platform, manhole rungs, vent pipe, frost strap, benching, lifting chain, slide rail, power supply, control panel, connection to existing forcemain and all other items to have a complete and operable pumping system;

all in accordance with design brief, final drawings and specifications, as prepared by B. M. Ross and Associates Limited.

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 12th *day of* February, 1999.

THIS IS A TRUE COPY OF THE ORIGINAL CERTIFICATE MAILED

ON February 18, 1999

V. K.
(SIGNED)

M. Dhalla, P.Eng.,
Director,
Section 53,
Ontario Water Resources Act.

PF/vk

Attn: - E.C. Brubacher, Administrator-Clerk, Town of Mount Forest
cc: - District Manager, MOE Guelph District Office
- B. M. Ross and Associates Ltd.

APPENDIX J
PERTH STREET SPS HOURS

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST
PERTH STREET SEWAGE PUMPING STATION (SPS)

PUMP RUN TIMES (HRS)

Month	2017				2018				2019			
	Pump 1	Pump 2	Total	Avg (hrs/d)	Pump 1	Pump 2	Total	Avg (hrs/d)	Pump 1	Pump 2	Total	Avg (hrs/d)
Jan	16.13	166.65	182.78	5.9	18.98	18.98	37.96	1.2	24.72	24.85	49.57	1.6
Feb	54.79	20.47	75.26	2.7	18.97	18.36	37.33	1.3	21.75	21.77	43.52	1.6
Mar	35.23	35.11	70.34	2.3	20.06	19.20	39.26	1.3	27.43	27.72	55.15	1.8
Apr	28.80	29.09	57.89	1.9	29.66	29.86	59.52	2	40.46	8.4	48.86	1.6
May	30.84	30.96	61.8	2	26.61	26.02	52.63	1.7	38.12	39.2	77.32	2.5
Jun	22.75	23.10	45.85	1.5	17.38	17.15	34.53	1.2	25.48	26.6	52.08	1.7
Jul	20.60	20.78	41.38	1.3	11.19	10.85	22.04	0.7	14.24	13.5	27.74	0.9
Aug	15.23	14.53	29.76	1	17.10	17.63	34.73	1.1	8.4	8.3	16.7	0.5
Sep	11.91	11.45	23.36	0.8	13.77	14.33	28.1	0.9	7.66	7.7	15.36	0.5
Oct	12.27	12.09	24.36	0.8	14.41	13.78	28.19	0.9	6.78	6.8	13.58	0.4
Nov	20.33	20.09	40.42	1.3	22.94	23.43	46.37	1.5	17.31	17.2	34.51	1.2
Dec	18.57	18.29	36.86	1.2	31.08	30.54	61.62	2	19.9	19.8	39.7	1.3
Total			690.06				482.28				474.09	
Average			1.9				1.3				1.3	

Something odd with these results. Was pump partially plugged and not working properly?

If ignoring the month of January:

Total	507.28
Average	1.5

APPENDIX K
RESERVE CAPACITY CALCULATIONS

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

105 Queen Street West, Unit 14
Fergus
Ontario N1M 1S6
Tel: (519) 843-3920
Fax: (519) 843-1943
Email: info@tritoneng.on.ca

ORANGEVILLE • FERGUS • GRAVENHURST

February 4, 2020

Township of Wellington North
Box 125, 7490 Sideroad 7 West
KENILWORTH, Ontario
N0G 2E0

Attention: Darren Jones
Chief Building Official

RE: TOWNSHIP OF WELLINGTON NORTH
2020 RESERVE CAPACITY CALCULATIONS
MT. FOREST WASTEWATER TREATMENT PLANT (WWTP)
OUR FILE: A5510(20) R03

Dear Sir:

We have undertaken a review of the reserve capacity for the Mount Forest Wastewater Treatment Plant (WWTP) for 2020 in accordance with the requirements outlined in the Ministry of Environment, Conservation and Parks (MOECP) Guidelines. The current Average Day Flow (ADF) is based on recorded flows at the plant for a three (3) year period (2017, 2018 and 2019) as provided by the Ontario Clean Water Agency (OCWA). We have also updated the population and number of households based on the 2016 Statistics Canada Census data for the community of Mount Forest.

The reserve capacity calculations indicate a minor increase in the three (3) year ADF from 2,117 m^3/day to 2,121 m^3/day. Calculations provided in Table 1 (attached) indicate the uncommitted reserve capacity has increased from 584 to 591 equivalent residential units.

Registered/Unbuilt development figures provided in Table 2 (attached) have been adjusted to include Building Permits issued in 2019 as provided by the Chief Building Official. Thirty-eight (38) additional units were connected to the collection system in 2019.

Following Council's review and adoption of the attached report, we would recommend that a copy of the report be forwarded to the MOECP Guelph District Office to the attention of Lisa Williamson. We trust you will find the enclosed to be in order. Should you have any questions, please do not hesitate to contact the undersigned.

Yours very truly,

TRITON ENGINEERING SERVICES LIMITED

O. Di Carlo, P.Eng.

OD/sjp
Encl.
cc: Matt Aston, Director of Operations, Township of Wellington North
Corey Schmidt, Water & Sewer Supervisor, Township of Wellington North
Paul Ziegler, C.E.T., Triton Engineering Services Limited

TABLE 1 MOUNT FOREST - WWTP 2020 RESERVE CAPACITY		
DESCRIPTION		**2020**
1	Design capacity of WWTP (m^3/day)	2,818
2	Average day flow * (m^3/day)	2,121
3	Reserve capacity (m^3/day)	697
	(1) - (2)	
4	Population served **	4,914
5	Serviced households ***	2,281
6	Average daily per capita flow (m^3/day)	0.43
	(2) ÷ (4)	
7	Additional population that can be served	1621
	(3) ÷ (6)	
8	Persons per equivalent residential unit	2.15
	(4) ÷ (5)	
9	Additional equivalent residential units that can be served	754
	(7) ÷ (8)	
10	Committed Development (Table 2)	163
11	Uncommitted Reserve Capacity in Equivalent Residential Units	591
	(9) - (10)	
*	Average of 2017 (2,367 m^3/day),2018 (2,039 m^3/day) and 2019 (1,954 m^3/day)	
**	Estimated Population using 2016 Census (4,643) + ((units built in 2017, 2018 and 2019) x 2.15)	
***	Estimated residential sewage connections using 2016 households (2,155) + **(13 units in 2016 + 53 units in 2017 + 22 units in 2018 + 38 units in 2019)**	

TABLE 2
MOUNT FOREST
SUMMARY OF COMMITTED DEVELOPMENT - 2020

REGISTERED/UNBUILT	REMAINING UNITS	UNITS USED IN 2019	TOTAL
Bye - Church St. (Plan 419)	0	1	
Reeves - Albert Street Estates	1	0	
Lucas Subdivision (King and Albert Streets)	25	3	
Martin Street (Betty Dee)	2	1	
Cork Street (South Saugeen Shores Development Inc.)	8	2	
466 Queen West (2551405 Ontario Ltd.)	0	0	
SUB-TOTAL	**36**	**7**	**43**
DRAFT PLAN APPROVED OR COMMITTED BY RESOLUTION	**UNITS**		
Welliington Street East (Peter and Mary Reeves)	1	3	
London Road Subdivision (Bye)	30	0	
488 Durham Street East (2574574 Ontario Inc.)	0	10	
Marlanna Homes Subdivision (400 King Street East)	24	0	
310 Sligo Road West (Sharpe)	20	0	
Mount Forest Developments Inc. (Church/Druham)	30	0	
Sharon Farms - 730 Princess Street	15	0	
SUB-TOTAL	**120**	**13**	**133**
MULTI-UNIT DEVELOPMENT			
SUB-TOTAL			**0**
INFILL LOTS			
	7	18	25
SUB-TOTAL	**7**	**18**	**25**
TOTAL COMMITTED UNITS	**163**	**38**	**201**

TOWNSHIP OF WELLINGTON NORTH
HYDRAULIC RESERVE CAPACITY [g]

Date: December 31, 2020

MOUNT FOREST WATER SUPPLY		
(1)	**Operational** firm well supply capacity [a]	5,976 m^3/day
(2)	Maximum day demand [b]	2,685 m^3/day
(3)	Reserve capacity [(1)-(2)]	3,291 m^3/day
(4)	Equivalent population served [c]	5,678 No. persons
(5)	Serviced households [c]	2,328 No. households
(6)	Maximum day per capita demand [d]	0.55 m^3/capita/day
(7)	Additional population [(3)/(6)]	5,984 No. persons
(8)	Persons per unit (assumed)	2.5 No. persons
(9)	Additional units that can be served [(7)/(8)]	2,394 No. households
(10)	Committed residential development [e]	166 No. households
(11)	**Uncommitted reserve capacity [(9)-(10)] [f]**	**2,228 No. households**

NOTES:

(a) Based on the January 6, 2021, technical update study, based on how the well stations are actually operated/throttled, and with the largest well supply (Well No. 6) assumed to be out of service.

(b) Based on the January 6, 2021, technical update study, for the period of 2015-2019

(c) Based on the Township's 2018 Growth Plan reports.

(d) Based on the January 6, 2021, technical update study: 275Lpcd x 2.0 max day factor

(e) Based on the January 6, 2021, technical update study Appendix A December 14, 2020, update report (146 committed + 3 infill built in 2020 + 17 approved units built in 2020 = 166)

(f) This is **equivalent residential unit** uncommitted reserve capacity.

(g) **Note: Above based on water supply considerations only**

TOWNSHIP OF WELLINGTON NORTH
HYDRAULIC RESERVE CAPACITY [f]

Date: December 31, 2020

MOUNT FOREST - CORK STREET S.P.S.		
(1)	**Pumping capacity** [a]	67 L/s
(2)	Peak pumping rate [b]	60.7 L/s
(3)	Reserve capacity [(1)-(2)]	6.3 L/s
(4)	Peak demand flow rate [c]	0.021 L/s/capita
(5)	Additional population [(3)/(4)]	300 No. persons
(6)	Persons per unit (assumed)	2.5 No. persons
(7)	Additional units that can be served [(5)/(6)]	120 No. households
(8)	Committed residential development [d]	25 No. households
(9)	**Uncommitted reserve capacity [(7)-(8)] [e]**	**95 No. households**

NOTES:

(a) Based on the January 6, 2021, technical update study, the design rated station capacity is 67L/s. However, note that data suggests the 99th percentile pumping rate in 2020 was 79.5L/s, but further data evaluation is required to establish actual inlet peak sewage flow as well as the actual installed (equipped) pump discharge capacity.

(b) Based on the January 6, 2021, technical update study, 99th percentile pumping rate, for the period of 2017 to early-January 2019

(c) Based on the January 6, 2021, technical update study 450Lpcd, and using 4.0 peak rate factor. This will yield an anticipated conservative evaluation. A more detailed evaluation can be completed at the time of any major developments to establish more accurately anticiapted peak flow rates.

(d) Based on the January 6, 2021, technical update study Appendix A December 14, 2020, update report (22 committed + 3 built in 2020, within the Cork St SPS catchment area)

(e) This is **equivalent residential unit** uncommitted reserve capacity.

(f) **Note: Above based on design pumping capacity considerations only**

TOWNSHIP OF WELLINGTON NORTH
HYDRAULIC RESERVE CAPACITY [f]

Date: December 31, 2020

MOUNT FOREST - DURHAM STREET S.P.S.		
(1)	**Pumping capacity** [a]	130 L/s
(2)	Peak pumping rate [b]	78.9 L/s
(3)	Reserve capacity [(1)-(2)]	51.1 L/s
(4)	Peak demand flow rate [c]	0.021 L/s/capita
(5)	Additional population [(3)/(4)]	2,433 No. persons
(6)	Persons per unit (assumed)	2.5 No. persons
(7)	Additional units that can be served [(5)/(6)]	973 No. households
(8)	Committed residential development [d]	12 No. households
(9)	**Uncommitted reserve capacity [(7)-(8)]** [e]	**961 No. households**

NOTES:

(a) Based on the January 6, 2021, technical update study, based on the design rated station capacity.

(b) Based on the January 6, 2021, technical update study, 99th percentile pumping rate, for the period of 2017-2019

(c) Based on the January 6, 2021, technical update study 450Lpcd, and using 4.0 peak rate factor. This will yield an anticipated conservative evaluation. A more detailed evaluation can be completed at the time of any major developments to establish more accurately anticiapted peak flow rates.

(d) Based on the January 6, 2021, technical update study Appendix A December 14, 2020, update report (12 committed, within the Durham St SPS catchment area)

(e) This is **equivalent residential unit** uncommitted reserve capacity.

(f) **Note: Above based on design pumping capacity considerations only**

TOWNSHIP OF WELLINGTON NORTH
HYDRAULIC RESERVE CAPACITY [f]

Date: December 31, 2020

MOUNT FOREST - NORTH WATER STREET S.P.S.		
(1)	**Pumping capacity** [a]	208.3 L/s
(2)	Peak pumping rate [b]	175.4 L/s
(3)	Reserve capacity [(1)-(2)]	32.9 L/s
(4)	Peak demand flow rate [c]	0.021 L/s/capita
(5)	Additional population [(3)/(4)]	1,567 No. persons
(6)	Persons per unit (assumed)	2.5 No. persons
(7)	Additional units that can be served [(5)/(6)]	627 No. households
(8)	Committed residential development [d]	166 No. households
(9)	**Uncommitted reserve capacity [(7)-(8)]** [e]	**461 No. households**

NOTES:

(a) Based on the January 6, 2021, technical update study, the apparent **actual (equipped)** station capacity is 208.3L/s. The design pumping capacity is 173L/s so the above 99th percentile peak pumping rate exceeds that amount. Further data evaluation is required to resolve actual inlet peak sewage flow, the actual installed (equipped) pump discharge capacity, and to confirm no issues at the WWTP resulting from an equipped capacity that is higher than the design capacity. **CAUTION NEEDS TO BE EXERCISED IN THE INTERPRETATION AND USE OF THE FOREGOING RESERVE CAPACITY CALCULATION.**

(b) Based on the January 6, 2021, technical update study, 99th percentile pumping rate, for the period of 2017-2019

(c) Based on the January 6, 2021, technical update study 450Lpcd, and using 4.0 peak rate factor. This will yield an anticipated conservative evaluation. A more detailed evaluation can be completed at the time of any major developments to establish more accurately anticiapted peak flow rates.

(d) Based on the January 6, 2021, technical update study Appendix A December 14, 2020, update report (146 committed + 3 infill built in 2020 + 17 approved units built in 2020 = 166)

(e) This is **equivalent residential unit** uncommitted reserve capacity.

(f) **Note: Above based on design pumping capacity considerations only**

EXHIBITS

1:30,000

MOUNT FORESTER

POSTER EXTENTS

1:300

1

1:400

2

1:400

3

1:400

4

1:300

5

1:400

6

1:400

7

1:300

8

1:500

9

1:300

10

1:700

11

N

Legend

- Hydrants
- Private Hydrant
- Valves
- Not Found
- Blowoff
- Yard Hydrant
- Well/Pumphouse
- Water Tower
- Roads
- 1m Contour Lines
- Waterbody
- Parcels
- Urban Boundary

Watermains (mm dia)

- Unknown
- <= 50
- 100
- 150
- 200
- 250
- 300
- 400
- 600

NOTES:
This is a schematic representation of the water distribution system (and roadways). While this drawing and its detail views are shown to a scale, symbols, roadway widths, and watermains are not plotted to scale. Exact locations of many works are not known (based on old non-GPS data). This mapping should be used for general information purposes only.

0 100 200 400 METRES

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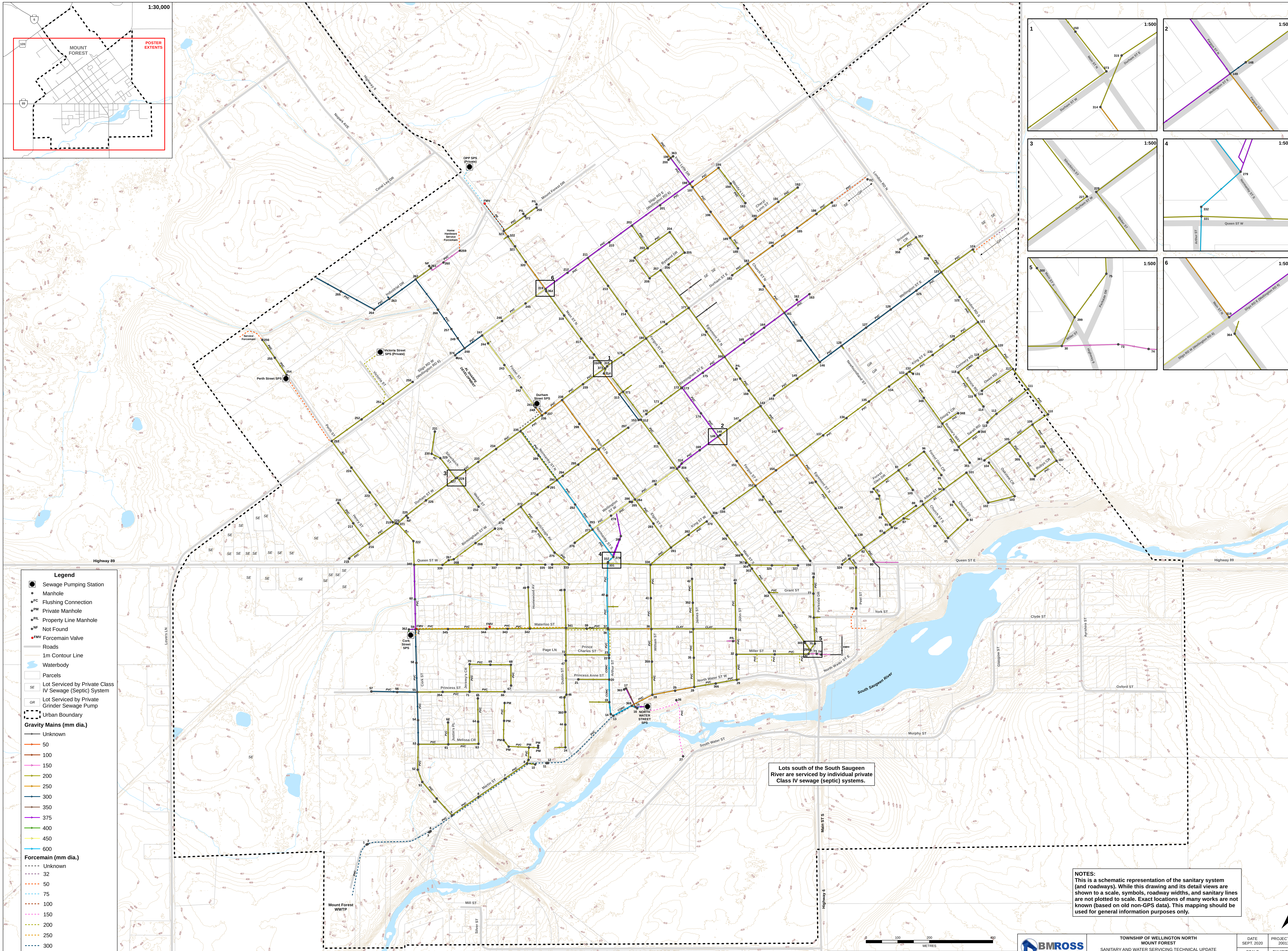
TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST
SANITARY AND WATER SERVICING TECHNICAL UPDATE
SCHEMATIC OF WATER DISTRIBUTION SYSTEM

DATE	PROJECT No.
SEPT. 2020	20013
SCALE	EXHIBIT No.
1:3,500	1



NOTES:
This is a schematic representation of the sanitary system (and roadways). While this drawing and its detail views are shown to a scale, symbols, roadway widths, and sanitary lines are not plotted to scale. Exact locations of many works are not known (based on old non-GPS data). This mapping should be used for general information purposes only.

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engineering better communities

TOWNSHIP OF WELLINGTON NORTH
MOUNT FOREST
SANITARY AND WATER SERVICING TECHNICAL UPDATE
SCHEMATIC OF SANITARY SYSTEM

DATE SEPT. 2020	PROJECT No. 20013
SCALE 1:3,500	EXHIBIT No. 2