Existing & Future Conditions Review

Norwood Infrastructure Assessment
Village of Norwood
Engage Project No. 19055

Engage Engineering Ltd.

May 2021

Re-Issued for Submission

REVISION SUMMARY

Revision No.	Revision Title	Date	Revision Summary
1	Existing Conditions	January 15th, 2020	Issued for Client Review
2	Existing & Future Conditions	April 23rd, 2020	Issued for Client Review
3	Existing & Future Conditions	July 3rd, 2020	Issued for Client Review
4	Existing & Future Conditions	July 23rd, 2020	Issued for Submission
5	Existing & Future Conditions	May 19th 2021	Re-Issued for Submission

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1.0 Introduction

1.1 Purpose

Engage Engineering Limited (Engage) has been retained by the Township of Asphodel Norwood (Township) to prepare an infrastructure assessment for future growth within the Village of Norwood (Village). This report summarizes both the existing and future conditions. It presents the conditions of the sanitary collection system and water distribution system within the village as well as identifies plant conditions within both the water and wastewater plants under current and future scenarios.

Future development areas have been established through correspondence with the Township. The future areas for development were separated into three phases: proposed developments, future developments and distant future developments based on the anticipated timeline of the development. Included in Phase 1 are the proposed development areas which are developments that the Township identified as the most likely to occur and have applications underway. Included in Phase 2 are the future development areas identified by the Township as areas that will be developed but do not have applications started. Phase 3 are the distant future development areas which include areas that the Township see being developed at some point in the distant future but are with a lower degree of certainty. The future development areas within each phase are outlined in **Figure 3** and summarized in **Table 1** below.

Table 1 – Future Works Phasing Summary

	Phase 1	Phase 2	Phase 3
No. of Development Areas	3	3	5
Total Area (ha)	58.40	23.34	70.72
No. of Residential Units	589	267	962
No. of Townhouse Units	146	-	20
No. of Retirement Home Units	100	80	-
Industrial Area (ha)	7.97	-	-

Based upon these future development areas, recommended upgrades to the current infrastructure as well as the timing of these upgrades have been identified and described. The ultimate goal of this assessment is for the Township to prepare for future growth of the Village and be aware of the infrastructure upgrades required to support the growth.

2.0 Sanitary Servicing

2.1 Existing Conditions

The existing sanitary collection system and wastewater treatment plant that services the Village of Norwood is owned and operated by the Township of Asphodel-Norwood. The wastewater system is comprised of the following infrastructure:

- One wastewater treatment plant located on Industrial Drive.
- Three municipal pumping stations.
- Gravity collection system consisting generally of 200mm sanitary sewer with varying material types (asbestos concrete, vitrified clay, PVC)

The Township provided treatment plant capacity and sewage flow data for the last ten years of operation, 2010-2019. The data was amalgamated and average daily flows for each year were obtained. A summary of the data is included in **Appendix A**.

The wastewater treatment plant in Norwood has a maximum capacity of 1,500m³/day with records showing the average daily flow of the ten years to be 522m³/day. Therefore, the plant is currently operating at 35% capacity. Refer to **Appendix A** for Norwood treatment plant capacity and sewage flows.

The locations and sizes of the existing sanitary sewers are shown on the Sanitary Collection System Plan included as **Figure 1**. The proposed sanitary sewer upgrades for Norwood Park Phase 3 subdivision have been considered in the existing conditions phase as approval is currently in progress.

2.2 Design Criteria

Design criteria to analyze the wastewater flow for the village has been assembled from MOE and the Township requirements and includes:

- Residential sewage flow of 450 L/person/day.
- Commercial sewage flow of 28 m³/ha/day (0.33 L/s/ha)
- School sewage flow of 70 L/student/day
- Retirement home sewage flow of 450 L/bed/day
- Norwood Fair sewage flow of 25 L/attendee/day
- Townhome units to have capacity of 2.4 persons/unit
- Single detached residential lots to have capacity of 2.5 persons/unit for existing conditions
- Single detached residential lots to have capacity of 3.0 persons/unit* for future conditions
- Harmon peaking formula to be applied to residential flows
- Infiltration rate of 0.09 L/ha/s for inflow and infiltration for existing conditions
- Infiltration rate of 0.28 L/ha/s* for inflow and infiltration for future conditions

*The future condition values were determined by the Township based upon the demographics of the Township and the potential to have separate basement units within a single-family home. The MOE infiltration value was conservatively used for future planning.

2.3   Proposed Flows & Wastewater Treatment Plant Capacity

Sewage flow rates for the existing conditions were analyzed based on MOE guidelines and the existing sewage flow data that was provided by the Township, included in **Appendix A**. The data from the highest demand year, 2010 was conservatively utilized. An infiltration rate of 0.28L/ha/s has been used for the analysis of the future conditions at this time. The Township has indicated that CCTV and rehabilitation work has taken place over the last several of years in order to reduce the amount of inflow and infiltration into the system. Additional time and monitoring is required to confirm the reduction in infiltration and hence sanitary flows prior to a specific value that better represents the current Village conditions can be utilized. This rate will be applied when the information becomes available.

Based on the design criteria outlined above, the total average sewage flows from all future developments has been calculated. The results are summarized in **Table 2** below and detailed calculations are included in **Appendix B**.

Table 2 – Proposed Sewage Flow

Flow Type	Phase 1 Flow (m³/day)	Phase 2 Flow (m³/day)	Phase 3 Flow (m³/day)
Single Family Residential Flow	795.2	360.5	1298.7
Townhome Residential Flow	157.7	-	21.6
Retirement Home Flow	45.0	36.0	-
Industrial Flow	440.7	-	-
Infiltration Flow	1412.8	564.64	1710.9
Average Design Flow	2851.4	961.1	3031.2

The capacity of the existing wastewater treatment plant was analyzed based upon the highest demand year to confirm the residual capacity available to accommodate future development within the Village. The existing flows were combined with the future flows to demonstrate the total flow. The results are presented in **Table 3** below.

Table 3 – Wastewater Treatment Plant Capacity

Flow Type	Average Daily Flow (m³/day)	Rated Capacity of Wastewater Treatment Plant (m³/day)	Wastewater Treatment Plant Capacity (%)
Existing Flows (to date)	579	1,500	39
EX + Phase 1 Flows	3,430	1,500	229
EX + PH 1 + Phase 2 Flows	4,392	1,500	293
EX + PH 1 + PH 2 + Phase 3 Flows	7,423	1,500	495

The results indicate that based upon the existing flow data, the wastewater treatment plant has some residual capacity for future developments, however, does not have sufficient capacity to accommodate all future development areas identified. A further investigation determined that approximately 289 single family units can be accommodated prior to plant upgrades being required. Single family home developments with less than 289 units will not create a capacity problem within the wastewater treatment plant. The Township will need to be mindful of this allocation on a first come, first serve basis for future development areas. Detailed calculations are included in **Appendix C**. A Municipal Class EA is required to support upgrades to the wastewater treatment plant including assessment of existing plant operations and recommendations for expansion.

2.4   Pumping Stations

Through correspondence with the Township it was determined that the Lions Park pumping station would be investigated. The Belmont Street and Maple Avenue pumping stations are not a concern as they are operating satisfactorily under existing conditions and there is little or no future development potential contributing to these stations.

The Lions Park pumping station currently consists of two submersible pumps rated at 55.1 L/s. The rated peak flow capacity of the pumping station is based on only one pump in service which equates to 4,761m³/day. The background information on the pumping station is included in **Appendix A**. Influent hourly peak flow data for 2017-2020 was obtained from the Township in order to assess the pumping station based on the peak hourly flows. The maximum peak hourly flow from the four years was utilized and is displayed in **Table 4** below and the historical influent flow data is summarized in **Appendix A**.

Based on theoretical peak flow calculations, the pumping station capacity is exceeded under existing conditions as outlined in **Table 4** below. When utilizing the highest hourly peak flow from the historical data, the pumping station is operating at 84% capacity. The discrepancy between the actual and calculated values is not unexpected as the MOE guidelines utilized for the theoretical calculations are conservative. There is some residual capacity in the pumping station if we utilize actual values. A further investigation

determined that based on the actual flow data, approximately 94 single family units can be accommodated prior to pumping station upgrades being required. The capacity of the pumping station will need to be increased during Phase 1 in order to accommodate flows from the future development areas. Calculations are included in **Appendix D**. A Municipal Class EA is required to support upgrades to the Lion's Park pumping station including evaluating the feasibility of upgrading the station versus construction of a new station.

Table 4 – Peak Pumping Station Capacity

Flow Type	Peak Flow (L/s)	Rated Capacity of Pumping Station (L/s)	Pumping Station Capacity (%)
Existing Flows (Actual)	46.5	55.1	84
Existing Flows (Calculated)	64.9	55.1	118
Existing + Phase 1 Flows	155.8	55.1	283
Existing + Phase 2 Flows	175.3	55.1	318
Existing + Phase 3 Flows	236.3	55.1	429

2.5   Forcemain

The existing 200mm diameter forcemain from the Lions Park pumping station to the wastewater treatment plant was analyzed under existing and future peak flows. The velocity was calculated to check if it falls between the MOE guidelines of 0.6-3.0m/s. The friction loss was calculated to determine the total losses in the forcemain. It was concluded that the existing 200mm diameter forcemain is sufficient for the existing peak flows. The forcemain will require to be upgraded for the phase 1 developments as the velocity and friction loss are increased beyond allowable as demonstrated in **Table 5**. A specific unit count cannot be determined as the pumping station upgrades will affect the forcemain upgrades and the two items will need to be coordinated together during the development of the phase 1 lands. It was determined that a 375mm diameter forcemain is adequate for the final future conditions of all developments. With the future flows determined the velocity in a 375mm diameter forcemain will be within the MOE guidelines and the resultant friction losses will be within a reasonable range for typical pump sizing. Instead of a single 375mm diameter forcemain, the Township could also consider leaving the existing forcemain in place and adding a 300mm diameter forcemain, which would provide some redundancy. The forcemain, pumping equipment and the station itself all function as an integrated system. Upgrades or replacement of any of these components should be considered as a system and the effect on all aspects including the forcemain, pumping equipment and the station itself should be considered and understood. This could be completed as part of a municipal Class EA study on the pumping station to determine the best solution that meets both interim and long-term development needs. A summary of the forcemain calculations is included in **Appendix E**.

Table 5 – Forcemain Analysis

Flow Type	Peak Flow (L/s)	Diameter Forcemain (mm)	Velocity (m/s)	Friction Loss (m)
Existing Flows	46.5	200	1.5	9.9
Existing + Phase 1 Flows	155.8	200	5.0	92.3
Existing + Phase 2 Flows	175.3	200	5.6	114.8
Existing + Phase 3 Flows	236.3	200	7.5	199.4
Existing + Phase 3 Flows	236.3	375	2.1	11.2

2.6   Sewer Capacity Analysis

The capacity of the existing sanitary sewers within the Village were analyzed to confirm the current operating conditions. A sanitary sewer design sheet was prepared to document flows, resultant pipe capacities and sewer velocities. Flows and velocities were calculated based on the design criteria and infiltration presented earlier in this report. The sanitary sewer design sheet is included in **Appendix F**.

The Sanitary Drainage Area Plan included in **Figure 2** shows the existing sewer locations with maintenance hole ID numbers and supporting sanitary drainage areas. The drainage area plan was prepared using as-built drawings obtained from the Township. Pipe material, slope and lengths were obtained from as-built drawings provided by the Township. The pipe material for many pipes was not indicated on the as-builts and concrete pipe was assumed.

The future development areas described in Section 1.1 are delineated on the Future Works Sanitary Drainage Area Plan included as **Figure 4**. The unit counts were determined from concept plans where available and by using a density of 14 units/hectare for all other areas. This density was determined by using an average density from Norwood Park Phase 3 and the future development on Mill Street as it was determined that this average would represent a typical density target for future developments.

The capacity of the sewers in both existing and future conditions are included in **Appendix F**. The sanitary system has been analyzed from all major intersections or changes in pipe size. The lowest slope within each section has been conservatively used. The sewer upgrades required for the Norwood Park Phase 3 development have not been included as future upgrades as they are currently underway. Under existing conditions, no sections of sewer are operating above 100% and two sections are operating above 80% capacity. Under future conditions, there are 17 sections of sewer which are operating above 100% capacity and require upgrades. The sections of sewer which require upgrading are identified in red on **Figure 4** and future pipe sizes are summarized in **Table 6** below.

A further investigation was undertaken to identify the approximate number of units that can be accommodated in each stretch of sewer prior to upgrades being required at 80% capacity. The analysis was completed on each section individually and is exclusive to runs

before and after. The Township will need to be mindful of this and look to the lowest unit count downstream that can be accommodated for any given development to see the constraint.

Table 6 – Sanitary Sewer Sizing Summary

Sewer Location	Manhole ID	Existing Pipe Diameter (mm)	# of Units Prior to Upgrade Required	Future Pipe Diameter (mm)
Pine Street	MH2A to MH27	200 mm	142	250 mm
Pine Street	MH27 to MH16	200 mm	102	300 mm
Pine Street	MH16 to MH4	200 mm	175	250 mm
Spring Street	MH4 to MH7	200 mm	50	300 mm
Albine Street	MH17A to MH201	200 mm	55	300 mm
County Road 40	MH201 MH59	200 mm	0	300 mm
County Road 45	MH7 to MH33	200 mm	87	250 mm
Elm Street	MH80 to MH105	200 mm	110	300 mm
Elm Street	MH105 to MH41	200 mm	0	375 mm
Queen Street	MH41 to MH45	200 mm	0	375 mm
Queen Street	MH45 to MH166	200 mm	0	375 mm
Victoria Street	MH97 to MH101	200 mm	105	300 mm
Victoria Street	MH101 to MH166	200 mm	42	375 mm
Pumping Station	MH166 to MH124	250 mm	42	450 mm

2.7   Proposed Sewer

Due to the numerous development areas in the southeast of the Village boundary, new sanitary sewer is being proposed along County Road 42. This sewer will connect into the existing sewer on Victoria Street. The new sewer has been determined as a 300mm diameter sewer which has been assumed to service Phase B of the future development located at 2291 County Road 45 and the lands located at 1552 County Road 42. The approximate location for the new sewer is shown on **Figure 4**.

3.0 Water Servicing

3.1 Existing Conditions

The existing water distribution system that services the Village of Norwood is owned and operated by the Township of Asphodel-Norwood. The municipal drinking water system is comprised of the following infrastructure:

- Four municipal wells, with low lift pumping stations and treatment systems
- One municipal water tower (standpipe) with a capacity of 1283m³
- Approximately 13km of watermain piping ranging in size (from 32mm to 250mm) and material type (black iron, ductile iron, asbestos cement and PVC)

The Township provided the water treatment plant capacity and daily water consumption data for the last ten years of operation, 2010-2019. The data was amalgamated and average daily flows for each year were obtained. A summary of the data is included in **Appendix A**.

As requested by the Township, the data from 2010 has been excluded from the historical averages. It was determined that the data from this year is an outlier and was a result of a watermain break during a road reconstruction project. The data from years 2011-2019 has been utilized in the analysis below. There is generally a decreasing trend in the water consumption which is presumed to be a result of the implementation of water metering as well as the ongoing infrastructure improvements that the Township is undertaking to reduce leakage throughout the Village.

The municipal drinking water system in Norwood has a rated capacity of 1,965 m³/day (maximum flow rate). The locations and sizes of the existing watermains in the Village are shown on the Water Distribution Plan included as **Figure 5**.

3.2 Design Criteria

Design criteria to analyze the future water demand for the Village has been assembled from MOE and the Township requirements and includes:

- Residential water demand of 450 L/person/day.
- Townhome units to have capacity of 2.4 persons/unit
- Single detached residential lots to have capacity of 3.0 persons/unit
- Maximum day factor of 2.00 (based on a future population of 8452)
- Peak hour factor of 3.00 (based on a future population of 8452)
- Minimum fire flow of 2000 L/min
- The minimum pressure of the system shall meet or exceed 40 psi (275 kPa) during normal operating conditions.
- The minimum pressure of the system shall meet or exceed 20 psi (138 kPa) during maximum day plus fire flow conditions.

3.3 Drinking Water Treatment System Capacity

Based on a Statistics Canada Census Profile from 2016 the Village of Norwood has a population of 1,380. Actual water consumption rates of users have been collected over nine years and the data from the highest demand year (2011) has been used for the analysis. The data is included in **Table 7** below.

Table 7 – Existing Water Consumption

Year	Average Daily Flow (m³/day)	Minimum Daily Flow (m³/day)	Maximum Daily Flow (m³/day)
2011	694	461	1,259

Based on the design criteria listed above, the domestic water demands for the future developments have been calculated. The results are included in **Appendix G** and summarized in **Table 8** below.

Table 8 – Future Domestic Water Flow

Flow Type	Phase 1 Flow (m³/day)	Phase 2 Flow (m³/day)	Phase 3 Flow (m³/day)
Average Day Flow	1438.5	396.5	1320.3
Maximum Day Flow	2877.1	792.9	2640.6
Peak Hour Flow	4315.6	1189.4	3960.9
Fire Flow	2880.0	2880.0	2880.0
Maximum Day + Fire Flow	**5757.1**	**3672.9**	**5520.6**

The capacity of the existing Norwood drinking water system was analyzed to confirm if it can accommodate the additional flows to service the future developments. The average maximum daily flow measured over the last nine years was utilized for the existing condition. The results are presented in **Table 9** below.

Table 9 – Norwood Drinking Water System Capacity

Flow Type	Maximum Daily Flow (m³/day)	Rated Capacity of Drinking Water System (m³/day)	Drinking Water System Capacity (%)
Existing Flows (Average to date)	1,003	1,965	51
EX + Phase 1 Flows	3,880	1,965	198
EX + PH 1 + Phase 2 Flows	4,673	1,965	238
EX + PH 1 + PH2 + Phase 3 Flows	7,314	1,965	372

Based on the above information, the capacity in the drinking water treatment system is not adequate to supply for the future development areas and upgrades will be required to increase the capacity during the development of Phase 1 lands.

The average maximum daily flow measured over the last nine years is 1,003m^3/day, resulting in a theoretical available maximum day capacity of 962 m^3/day for future development. This equates to approximately 356 additional residential units, assuming 3.0 persons per unit and maximum day demands. Calculations are included in **Appendix H**. A Municipal Class EA is required to support the required upgrades to the water treatment plant including assessment of existing plant capacity and function and identifying the recommended means of expanding the plant capacity.

3.4 Proposed Watermain

Due to the numerous development areas in the southeast of the Village boundary, new watermain is being proposed along County Road 42. This watermain will connect into the existing watermain on Victoria Street. The new watermain has been specified as a 200mm diameter watermain and is assumed to service Phase B of the future development located at 2291 County Road 45 and the lands located at 1552 County Road 42. The approximate location of the new watermain is shown on **Figure 7**.

3.5 Treated Drinking Water Storage

The existing standpipe in the Village of Norwood has a total capacity of 1,283m^3. A design brief was unavailable for the original design of the standpipe, therefore as-built drawings were utilized to assess the current conditions of the standpipe. Based upon the current operating conditions of the standpipe the effective volume was determined to be 885m^3. The treated water storage required for both existing and future conditions was determined based upon the MOE guidelines and are summarized in **Table 10** below. Detailed calculations are included in **Appendix I**.

Table 10 – Treated Water Storage

Volume Type	Total Treated Water Storage Requirement (m³/)	Effective Volume in Standpipe (m³)	Standpipe Capacity (%)
Existing (to date)	1,024	885	116
EX + Phase 1	2,008	885	189
EX + PH 1 + Phase 2	2,392	885	225
EX + PH 1 + PH 2 + Phase 3	4,305	885	405

It was determined that the existing standpipe is under capacity for the existing population with no reserve capacity for future developments. Additional treated water storage is required for any future development areas. A water tower is likely the optimal solution to provide additional treated water storage as well as increase pressures throughout the system. Three potential locations for a new water tower are shown on **Figure 7**. The locations at the southeast of the village boundary and north of the public works building

on Highway 7 were selected based upon existing topography. The third potential location is adjacent the existing standpipe which is advantageous due to the proximity to the existing Water Treatment Plant. The other two locations would require new water treatment facilities in proximity. It is recommended that the Township undertake an investigation to identify the amount of water available in the Esker. Additionally, a Municipal Class EA study should be undertaken to determine the most appropriate location and type of future treated water storage.

3.6   Distribution System Pressures & Fire Flows

The existing system pressures were reviewed to ensure they fall within the MECP guidelines, as outlined below:

- Normal Operating Pressure   from 350 to 480 kPa (50 to 70 psi)
- Minimum Operating Pressure   >275 kPa (40 psi)
- Maximum Operating Pressure   <700 kPa (100 psi)
- Maximum day demand plus fire flow   >140kPa (20 psi)

Hydrant flow testing was obtained from the Township to analyze current system pressures and flows. The results from the flow and pressure testing results for the Village are included in **Appendix A**. Testing was performed on the hydrants in 2016 however not all areas of the distribution system have hydrant test data available, so some areas were not evaluated for existing pressure conditions. The results of the testing generally indicated that the static pressures are above 40 psi and below 70 psi indicating adequate pressures are available throughout the Village according to MOE guidelines. The Township is aware of some low-pressure issues and complaints from users in the system and so a measure should be considered to provide a moderate overall increase in system pressures. The distribution of static pressure ranges throughout the village are included on **Figure 6**.

The total 1 port flow at 20 psi was determined through the flow testing. The flow ranged from 653 gpm to 4275 gpm.

To confirm the available flow at a pressure of 40 psi the Hazen-Williams formula was employed for the minimum and maximum condition at respective hydrants. The minimum flow available within the village at 40 psi is 1257 l/min at hydrant 67 located at 4420 Highway 7. The maximum flow available within the village at 40 psi is 11,129 l/min at hydrant 24 located at 2362 County Road 45. For detailed calculations refer to **Appendix J**.

The approximate elevations for the future developments are included on **Figure 7**. The highest elevation based on GIS contour data has been identified. Based upon this information it may be difficult to achieve adequate pressures with the existing standpipe for some of the developments. The developments include those north of Mill Pond, west of Wellington and the south east corner of the Village boundary based upon their elevations. This will need to be evaluated when the proposed grading for the developments is established, however the new water tower should be designed in order to satisfy pressure requirements as well as treated water storage requirements.

4.0 Summary

Engage has been retained by the Township of Asphodel-Norwood to review the existing municipal services within the Village in order to plan for future growth. The assessment summarizes the existing and future conditions. The conditions of the sanitary collection system and water distribution system as well as plant conditions have been analyzed for both existing and future conditions. Future areas for development were separated into three categories: proposed developments, future developments and distant future developments based on the anticipated timeline of the development. The results have been displayed with respect to the three phases.

The existing gravity sanitary sewer system for the Village of Norwood was analyzed. Based on the calculated flows using the design criteria discussed with the Township, all sections are currently operating below 100% capacity and there are two sections that are operating above 80% capacity. The sanitary sewer system was assessed when all future development areas are considered. This resulted in 17 sections of sewer exceeding 100% capacity which require to be upgraded to accommodate future development areas. The sizing of the proposed sewers to accommodate the additional flows was provided for each section of sewer requiring upgrading. An additional investigation determined the number of units that can be accommodated in each stretch of sewer prior to upgrades being required.

The capacity of the wastewater treatment plant was analyzed based on actual average flow data from ten years of operation. It was concluded that the existing wastewater treatment plant has capacity to accept flows from 289 future residential units. Upgrades will be required to the plant for any additional development exceeding 289 units. It was determined that plant upgrades will be required during Phase 1.

The capacity of the existing Lions Park pumping station was analyzed based on peak flow data. Based on historical hourly flow data, the pumping station is currently operating at 84% capacity and has capacity to accommodate 94 residential units prior to upgrades. It was concluded that upgrades will be required to the pumping station in Phase 1.

The existing 200mm diameter forcemain was analyzed based on peak flow data. The forcemain is adequate for the existing conditions however will need to be upgraded in conjunction with the pumping station upgrades during phase 1. The future size of the forcemain was determined to be 375mm diameter, however the Township could also consider adding an additional forcemain adjacent the existing forcemain to provide redundancy.

The water distribution system was analyzed under existing and future conditions. The capacity of the water treatment plant was analyzed based on actual flow data from ten years of operation. It was determined that there is residual capacity in the water distribution system for 356 future residential units. Upgrades will be required to the water treatment plant for additional development upon this during the Phase 1 developments.

The existing standpipe was analyzed to assess the treated water storage available for future developments. It was concluded that the existing standpipe is under capacity for the existing conditions with no reserve capacity for future developments. A new water tower should be investigated to increase the treated water supply and increase pressure throughout the system prior to Phase 1 of the future development occurring. Potential locations for a new water tower have been identified and should be investigated further to determine the optimal solution.

The future development areas identified by the Township have a large impact on both the existing sanitary and water systems within the Village. Upgrades are required to both systems in order to support the future growth of the Village.

Prepared by: Reviewed by:

Mackenzie Crowley,   Paul Hurley, P. Eng
EIT   Principal

Figure 1 - Sanitary Collection System

MILL POND

OUSE RIVER

WASTEWATER
TREATMENT PLANT

BELMONT
PUMPING
STATION

LION'S PARK
PUMPING
STATION

MAPLE AVE
PUMPING STATION

Street labels:
ALBINE ST, MILLPOND LN, HELEN'S ST, MARGARET AVE, HELEN ST, COUNTY ROAD 40, WELLINGTON ST, RIDGE ST, VICTORIA ST, COUNTY ROAD 45, SPRING ST, PINE ST, OAK ST, MURRAY ST, ROBERTI RD, MILL ST, LEGION ST, CEDAR ST, ELM ST, QUEEN ST, KING ST, FLORA ST, ALMA ST, VICTORIA ST, BAKER ST, MAPLE AVE, SPRUCE DR, BIRCH ST, INDUSTRIAL DR, COUNTY RD 42

Select pipe annotations:
200mm ø SAN 3.80%
200mm ø SAN 2.90%
200mm ø SAN 2.80%
200mm ø SAN 0.50%
300mm ø SAN 3.50%
116m - 200mm ø SAN 4.86%
119m-200mm SAN 0.4%
127m - 200mm ø SAN 0.4%
805m - 200mm SAN FORCE MAIN

Figure 2 - Existing Sanitary Drainage Area Plan

FIGURE 2 - EXISTING SANITARY DRAINAGE AREA PLAN

LEGEND

— VILLAGE BOUNDARY

— EXISTING SANITARY SEWER (AS-BUILTS NEEDED)

— EXISTING SANITARY SEWER

— SANITARY FORCE MAIN

SCHOOL AREA

COMMERCIAL AREA

RETIREMENT HOME AREA

INFILTRATION AREA: 21.45ha
SCHOOL POPULATION: 300
FAIR FLOWS: 10,000 PEOPLE @25L/PERSON/DAY

ENGAGE
ENGINEERING

NORWOOD INFRASTRUCTURE ASSESSMENT

FIGURE 2 - EXISTING SANITARY DRAINAGE AREA PLAN

DRAWN: K.SHARIA   APPROVED: P.HURLEY   SCALE: 1:4000   DATE: 2019-11-01   PROJECT No: 19055

Figure 3 - Future Works Phasing Plan

MILL POND

187 COUNTY ROAD 40

164 COUNTY ROAD 40

158 ALBINE STREET

ALBINE ST

MILLPOND LN

HELEN ST

MARGARET AVE

HELEN ST

MILLPOND LN

COUNTY ROAD 40

MILL ST

LEGION ST

CEDAR ST

QUEEN ST

ROLL NUMBER:
1501 010 003 15100

ROLL NUMBER:
1501 010 003 14900

ROLL NUMBER:
1501 010 003 06000

WELLINGTON ST

41 WELLINGTON STREET

VICTORIA ST

ELM ST

KING ST

MURRAY ST

RIDGE ST

ROBERT RD

PINE ST

SPRING ST

COUNTY ROAD 45

ALMA ST

1552 COUNTY ROAD 42

2307 ASPHODEL 8TH LINE

RIDGE ST

PINE ST

FLORA ST

2291 COUNTY ROAD 45 -
PHASE A

OAK ST

O U S E   R I V E R

2291 COUNTY ROAD 45 -
PHASE B

INDUSTRIAL DR

VICTORIA ST

BAKER ST

35 INDUSTRIAL DRIVE

SPRUCE DR

BIRCH ST

MAPLE AVE

COUNTY RD 42

7

LEGEND

VILLAGE BOUNDARY

PHASE 1: KNOWN PROPOSED
DEVELOPMENTS

PHASE 2: FUTURE
DEVELOPMENTS

PHASE 3: DISTANT FUTURE
DEVELOPMENTS

ENGAGE
ENGINEERING

NORWOOD INFRASTRUCTURE
ASSESSMENT

FIGURE 3 - FUTURE WORKS
PHASING PLAN

| DRAWN: | APPROVED: | SCALE: | DATE: | PROJECT No. |
| K.SHARIA | P.HURLEY | 1:5000 | 2020-07-21 | 19055 |

Figure 4 - Future Works Sanitary Drainage
Area Plan

FIGURE 4 - FUTURE WORKS
SANITARY DRAINAGE AREA PLAN

LEGEND

▬▬▬	VILLAGE BOUNDARY
▬▬▶	EXISTING SANITARY SEWER (AS-BUILTS NEEDED)
▬▬▶	EXISTING SANITARY SEWER
▬▬▶	SANITARY SEWER UPGRADES
▬▬▶	NEW SANITARY SEWER
▬▬▶	SANITARY FORCE MAIN

COMMERCIAL AREA (ha) — No. of Residential Units / Infiltration Area (ha)
INDUSTRIAL AREA (ha) — No. of Residential Units / Infiltration Area (ha)
TOWNHOUSE UNITS — No. of Residential Units / Infiltration Area (ha)
RETIREMENT HOME UNITS — No. of Residential Units / Infiltration Area (ha)
SCHOOL POPULATION — No. of Residential Units / Infiltration Area (ha)

▨	EXISTING SCHOOL AREA
▨	EXISTING COMMERCIAL AREA
▨	EXISTING RETIREMENT HOME AREA
▨	KNOWN PROPOSED DEVELOPMENTS
▨	FUTURE DEVELOPMENTS
▨	DISTANT FUTURE DEVELOPMENTS

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ASSESSMENT
FIGURE 4 - FUTURE WORKS
SANITARY DRAINAGE AREA PLAN

| DRAWN: A.LAUTENBACH | APPROVED: P.HURLEY | SCALE: 1:5000 | DATE: 2020-02-04 | PROJECT No. 19055 |

Figure 5 - Water Distribution Plan

VILLAGE OF NORWOOD

FIGURE 5 - WATER DISTRIBUTION PLAN

LEGEND
— VILLAGE BOUNDARY
--- EXISTING WATER MAIN
☼ EXISTING FIRE HYDRANT

Figure 6 - Hydrant Static Pressure Distribution Plan

LEGEND

———	VILLAGE BOUNDARY
– – –	EXISTING WATER MAIN
⬡	EXISTING FIRE HYDRANT
H00	STATIC PRESSURE 40 - 49 psi
H00	STATIC PRESSURE 50 - 59 psi
H00	STATIC PRESSURE 60 - 69 psi
H00	UNTESTED
✳	EXISTING WATER TOWER

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VILLAGE OF NORWOOD

FIGURE 6 - HYDRANT STATIC
PRESSURE DISTRIBUTION PLAN

DRAWN:	APPROVED	SCALE:	DATE:	PROJECT No.
A.LAUTENBACH	P.HURLEY	1:4500	2020-01-07	19055

Figure 7 - Future Works Water Distribution Plan

MILL POND

O U S E R I V E R

Streets labeled: ALBINE ST, MILLPOND LN, HELEN ST, CHARLES ST, MARGARET AVE, HELEN ST, COUNTY ROAD 40, WELLINGTON ST, CEDAR ST, LEGION ST, MILL ST, QUEEN ST, ELM ST, KING ST, ALMA ST, FLORA ST, RIDGE ST, VICTORIA ST, COUNTY ROAD 45, MURRAY ST, ROBERT RD, PINE ST, SPRING ST, RIDGE ST, PINE ST, VICTORIA ST, BAKER ST, MAPLE AVE, SPRUCE DR, BIRCH ST, COUNTY RD 42

LEGEND

——	VILLAGE BOUNDARY
- - -	EXISTING WATER MAIN
- - -	NEW WATER MAIN
⊡	EXISTING FIRE HYDRANT
H00	STATIC PRESSURE 40 - 49 psi
H00	STATIC PRESSURE 50 - 59 psi
H00	STATIC PRESSURE 60 - 69 psi
H00	UNTESTED
✱	EXISTING WATER TOWER
✱	PROPOSED WATER TOWER

Appendix A: As-Constructed Servicing Drawings/Background Information

Norwood Water Consumption   Hide?

Year	Average Daily Flow (m3/day)	Minimum Daily Flow (m3/day)	Maximum Daily Flow (m3/day)	Rated Capacity (m3/day)	Percent of Rated Capacity Used Per Year	
2010	722	323	1671	1965	37%	TWP wants to Omit 2010
2011	694	461	1259	1965	35%	
2012	583	267	944	1965	30%	
2013	542	416	911	1965	28%	
2014	520	391	1148	1965	26%	
2015	582	140	1191	1965	30%	
2016	543		815	1965	28%	
2017	529		860	1965	27%	
2018	593		1023	1965	30%	
2019	620		874	1965	32%	
10-Year Average	593		1070	1965	30%	
9-Year Average	578		1003	1965	29%	

NO 2010

Norwood Sewage Flows

Year	Average Daily Flow (m3/day)	Minimum Daily Flow (m3/day)	Maximum Daily Flow (m3/day)	Rated Capacity (m3/day)	Percent of Rated Capacity Used Per Year
2010	579	396	875	1500	39%
2011	566	290	1551	1500	38%
2012	488	378	833	1500	33%
2013	494	397	815	1500	33%
2014	513	372	1786	1500	34%
2015	424	234	590	1500	28%
2016	440		990	1500	29%
2017	565		2081	1500	38%
2018	573		1618	1500	38%
2019	573		1087	1500	38%
10-Year Average	522		2081	1500	35%

Township of Asphodel-Norwood
Village of Norwood and TVE   **2016**
Fire Hydrant Flows for Colour Coding as per NFPA - USGPM

	US Gal per minute	1500 +
	US Gal per minute	1000-1500
	US Gal per minute	500-1000
	US Gal per minute	500 -

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
Nov	10	159 County Road 40				-20	0	0	0
Nov	11	163 County Road 40	46	28	30	26	16	888	1154
Nov	12	181 County Rd 40	45	24	31	25	14	822	1124
18-Nov	13	52 Ridge Street	52	32	34	32	18	949	1295
Nov	14	68 Ridge Street	57	48	53	37	4	1163	3865
Nov	15	74 Ridge Street	55	16	52	35	3	671	2529
Nov	16	101 Robert Road	55	40	51	35	4	1061	3424
Nov	17	113 Robert Road	62	32	46	42	16	949	1598
16-Nov	18	Corner of Oak Street & Highway 7	62	18	56	42	6	712	2036
16-Nov	19	54 Spring Street	66	36	52	46	14	1007	1914
16-Nov	20	4222 Highway 7	62	32	55	42	7	949	2498
16-Nov	21	30 Spring Street	60	35	42	40	18	993	1528
16-Nov	22	Corner of Highway 7 & County Road 45	58	42	53	38	5	1087	3251
16-Nov	23	2369 County Road 45	56	60	38	36	18	1300	1890
16-Nov	24	2362 County Road 45	60	54	56	40	4	1233	4275
15-Nov	25	2346 County Road 45	64	45	50	44	14	1126	2089
16-Nov	26	2324 County Road 45	58	32	50	50	8	949	2553
16-Nov	27	2298 County Road 45	63	46	52	43	11	1138	2376

Township of Asphodel-Norwood
Village of Norwood and TVE
Fire Hydrant Flows for Colour Coding as per NFPA - USGPM

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
16-Nov	28	2272 County Road 45	66	39	58	46	8	1048	2695
16-Nov	29	2264 County Road 45	59	38	43	39	16	1034	1673
Nov	30	2254 County Road 45	56	40	43	36	13	1061	1839

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
17-Nov	31	22 Birch Street	57	16	26	37	31	671	738
17-Nov	32	7 Spruce Street	54	16	26	34	28	671	745
17-Nov	33	11 Maple Street	56	22	27	36	29	787	884
18-Nov	34	29 Maple Street	58	21	26	38	32	769	844
21-Nov	35	16 Baker Street	62	28	41	42	21	888	1291
18-Nov	36	40 Baker Street	56	40	43	36	13	1061	1839
17-Nov	37	11 Queen Street	60	38	42	40	18	1034	1592
17-Nov	38	21 Queen Street	60	40	35	40	25	1061	1368
17-Nov	39	38 Victoria Street	62	20	22	42	40	750	770
17-Nov	40	30 Queen Street	60	38	49	40	11	1034	2077
18-Nov	41	4289 Highway 7	60	25	32	40	28	839	1017
17-Nov	42	31 Elm Street	62	32	40	42	22	949	1346
17-Nov	43	40 Queen Street	60	30	40	40	20	919	1336
17-Nov	44	52 Queen Street	60	35	38	40	22	993	1371
17-Nov	45	61 Legion Street	60	12	56	40	4	581	2015
15-Nov	46	Highway 7 & Cedar Street	62	40	42	42	20	1061	1584
17-Nov	47	62 Queen Street	58	44	40	51	18	1113	1953
17-Nov	48	83 Queen Street	58	30	38	38	20	919	1300
17-Nov	49	26 Flora Street	63	20	60	43	3	750	3160
21-Nov	50	44 Elm Street (Norwood High School)	58	32	38	38	20	949	1342
16-Nov	51	Corner of County Road 45 & Birch Street	50	28	30	30	20	888	1105
16-Nov	52	55 Oak Street (St.Pauls School)	50	38	38	50	12	1034	2235
16-Nov	53	Corner of King Street and Mill Street	50	30	32	30	18	919	1211
17-Nov	54	23 Mill Street	58	30	34	38	24	919	1178
21-Nov	55	67 Mill Street	48	18	20	28	28	712	712

Township of Asphodel-Norwood

Village of Norwood and TVE

Fire Hydrant Flows for Colour Coding as per NFPA - USGPM

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
21-Nov	56	106 Mill Street	50	18	18	30	32	712	688
21-Nov	57	55 Alma Street	54	32	32	34	22	949	1201
21-Nov	58	79 Alma Street	59	20	22	39	37	750	772

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
21-Nov	59	99 Alma Street	52	22	28	32	24	787	919
21-Nov	60	Asphodel Norwood Community Centre	54	20	24	34	30	750	803
21-Nov	61	Norwood Fair Grounds	50	24	22	30	28	822	853
15-Nov	62	Corner of Wellington and Highway 7	60	35	42	40	18	993	1528
15-Nov	63	Corner of Mill Street & Highway 7	60	25	30	40	30	839	980
15-Nov	64	12 Belmont Street	54	25	26	34	28	839	932
15-Nov	65	26 Belmont Street	48	25	24	28	24	839	912
15-Nov	66	4388 Highway 7	50	20	22	30	28	750	779
15-Nov	67	4420 Highway 7	48	17.5	16	28	32	702	653
15-Nov	68	4408 Highway 7	50	25	20	30	30	839	839
15-Nov	69	4420Highway 7	48	19	15	28	30	731	705
17-Nov	70	11 King Street	58	35	40	38	18	993	1486
17-Nov	71	23 King Street	58	38	30	38	28	1034	1220
17-Nov	72	27 King Street	58	38	38	38	20	1034	1463
21-Nov	73	35 King Street	60	35	40	40	20	993	1443
15-Nov	74	4440 Highway 7	49	20	20	29	29	750	750
17-Nov	75	43 King Street	58	38	38	38	20	1034	1463
17-Nov	76	57 King Street	58	35	34	38	24	993	1272
Nov	77	67 King Street				-20	0	0	0
17-Nov	78	79 King Street	61	38	48	41	13	1034	1923
Nov	79	Corner County Road 40 & Ridge Street	61	37	49	41	12	1021	1982
Nov	80	37 County Road 40				-20	0	0	0
Nov	81	59 County Road 40				-20	0	0	0
Nov	82	77 County Road 40				-20	0	0	0
Nov	83	32 Helen Street				-20	0	0	0

Township of Asphodel-Norwood 653

Village of Norwood and TVE 4275

Fire Hydrant Flows for Colour Coding as per NFPA - USGPM

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
Nov	84	91 County Road 40				-20	0	0	0
Nov	85	105 County Road 40				-20	0	0	0
Nov	86	123 County Road 40				-20	0	0	0

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
Nov	87	137 County Road 40				-20	0	0	0
Nov	88	121 Robert Road				-20	0	0	0
Nov	89	6 Murray Street				-20	0	0	0
Nov	90	20 Murray Street				-20	0	0	0
Nov	91					-20	0	0	0
Nov	92					-20	0	0	0
Nov	93					-20	0	0	0
Nov	94					-20	0	0	0
Nov	95					-20	0	0	0
Nov	96					-20	0	0	0
Nov	97					-20	0	0	0
Nov	98					-20	0	0	0
Nov	99					-20	0	0	0
Nov	100					-20	0	0	0
Nov	101					-20	0	0	0
Nov	102					-20	0	0	0
Nov	103					-20	0	0	0
Nov	104					-20	0	0	0
Nov	105					-20	0	0	0
Nov	106					-20	0	0	0
Nov	107					-20	0	0	0
Nov	108					-20	0	0	0
Nov	109					-20	0	0	0
Nov	110					-20	0	0	0

Township of Asphodel-Norwood
Village of Norwood and TVE

Fire Hydrant Flows for Colour Coding as per NFPA - USGPM

Date	Hydrant Number	Street Location	Static Pressure	Pitot Pressure	Residual Pressure	hr Pressure	hf Pressure	1 Port Flow	Total 1 Port Flow at 20 psi
Nov	111					-20	0	0	0
Nov	112					-20	0	0	0

Table 2.3. Ultrasonic Level Transmitter

Tag Number	LIT-203
Number of Transmitters	1
Type	Ultrasonic
Manufacturer	Siemens
Model	Pointek ULS 200
Range (m)	0 – 1.0
High Alarm Setpoint (m)	201.510

Table 2.4. Level Switches

Tag Number	LSH-201	LSH-204
Location	Inlet	Outlet
Trigger Setpoint (m)	201.556	201.606
Type	Switch	Switch
Model	Flygt ENM-10	Flygt ENM-10
Action	Opens Motorized Gate	Notify Operator

2.1.8 Emergency Provisions

In the event of a sewer blockage within the water pollution control plant, sewage can be pumped from the inlet structure to any treatment system as required.

2.2 Raw Sewage Pumping Station

2.2.1 Functional Overview

An adequate hydraulic gradient must be provided to allow wastewater to travel through the plant by gravity. The raw sewage pumping station provides the lift required to reach the starting elevation for the headworks screening and grit removal operations and secondary treatment. The existing raw sewage pumping station is a wet well/dry well type. The dry well was decommissioned and the wet well was reconfigured into a submersible pumping station.

2.2.2 Unit Operation Description and Description of equipment

The raw sewage pumping station receives raw wastewater from the service area and pumps it to the headworks structure. The pumping station is comprised of the following.

2.1.4   Safety Procedures

Any person working in confined spaces must have undergone safety training and must be knowledgeable of such work.

Masks, respiratory equipment and other safety devices must be in place while performing work in such tanks.

2.1.5   Normal Operation

The normal operation of the inlet structure is transporting wastewater into the adjacent headworks and then the secondary treatment system. No monitoring is required.

2.1.6   Bypass Operation

The inlet sewer is the only path for sewage to flow to the water pollution control plant and therefore cannot be bypassed.

2.1.7   Instrumentation and Control

Instrumentation is available to monitor and measure the flow and level handled at the inlet structure. A 200 mm magnetic flowmeter is provided on the forcemain discharging into the inlet structure. This magnetic flowmeter is housed in a below grade maintenance hole structure. The inlet structure consists of three compartments: common inlet chamber, screen/grit channels and common outlet chamber. An ultrasonic level transmitter is located at the common inlet chamber and level switches are located in both inlet and outlet chambers.

Details of the magnetic flowmeter, ultrasonic level instrument and the level switches are summarized in Tables 2.2, 2.3 and 2.4.

Table 2.2. Raw Sewage Flowmeter

Tag Number	FIQT 200
Type	Magnetic
Flow (L/s)	0 – 110
Application	Raw Sewage from Service Area
Model	7ME6910
Manufacturer	Siemens
Chart Recorder	Yes

2.2.2.1 Discharge Header

The common discharge header is a 200 mm diameter pipe which discharges to the headworks structure.

2.2.2.2 Raw Sewage Pumps

Two (2) submersible pumps rated 55.1 L/s at 26.0 m TDH are located in the pumping station, each equipped with a variable frequency drive (VFD). The peak flow capacity of the pumping station is approximately 4,761 m^3/d.

Each pump is equipped with the following:

- 150 mm swing check valve and stales steel discharge pipe in the wet well; and
- 200 mm gate valve with extension stem and valve box/cover outside the wet well.

The details of the raw sewage pumps are summarized in Table 2.5.

Table 2.5. Raw Sewage Pump Data

Tag Number	RSP-101, RSP-102
Manufacturer	ITT Flygt
Model Number	AFP 1501-ME 250/6FM
Rated Capacity (L/s)	55.1
Head – TDH (m)	26
Power (kW)	
Supply	575/60/3
VFD Equipment	Yes

2.2.3 Safety Procedures

The following general safety precautions apply to the Raw Sewage Pumping Station:

- submersible pumps   -   electrical hazards
  -          isolation and tagging of equipment under maintenance;
  -          systems under pressure;
- refer to manuals on individual pieces of equipment for specific safety instruction regarding operation and maintenance;
- watch for and/or be cautious of any abnormal noise, vibration, temperature, pressure, voltage of current;
- use caution in investigating alarms and tripped out equipment. Ensure systems are isolated and tagged before commencing repair or resetting;

2.2.4 Normal Operation

The pumping station is fully automatic, and the pump operation is controlled by the liquid levels in the wet well.

During automatic operation of the raw sewage pumps, the PLC is in full control of the pumping station. However, setpoints for the pump operation have to be entered by the operator. Once setpoints have been entered, changes are rarely needed.

On a rotational basis, each of the two pumps will be used as lead. The PLC will rank the pumps for lead and lag duties and the rankings will be altered every 24 hours. The rotation of the rankings will be undertaken to try and achieve an equal amount of operating time for both pumps.

The typical duty cycle of the pumps is shown in the following Table 2.6.

Each pump duty will have a specific start and stop wet well level which is adjustable at the PLC. When the level reaches the start level of the first pump, the first duty pump will start and operate at 100 percent speed. as the level in the wet well decreases, the speed of the pump will decrease proportionally between the stop and stop level, with the target pump speed at the stop level being 75 percent of the overall pump speed.

On rising wet well level, when the level exceeds the start setpoint for the first duty pump, the first duty pump speed will remain at 100 percent until the start level for the second duty pump is reached. The second duty pump will then start at 100 percent speed and as the level falls in the wet well; its speed will be decreased proportionally to 75 percent speed at the second duty pump stop point.

The initial settings for the raw sewage pumps are summarized in the following Table 2.6.

Table 2.6. Summary of Raw Sewage Pumping Station Setpoints

Pump Duty	Stop Elevation (m)	Start Elevation (m)
1	190.826	191.209
2	190.826	191.409

General

Upon start up of any piece of equipment/instrumentation after installation, maintenance or repair, refer to the manufacturer's pre-starting checks in individual equipment/instrumentation's operation and maintenance manuals.

Refer to the individual manufacturer's safety checks and warnings before starting or placing any equipment into auto model.

Prior to starting motors which have been idle or unheated for extended periods, refer to the manufacturer's instructions.

Ensure all related and dependent systems are available for operation with the raw sewage pumping station.

Manual Start-up

Perform all checks as for automatic start-up.

Set sewage pump control(s) on manual start.

Run

The raw sewage pumps will operate in response to the liquid level in the wet well. When the liquid level rises to a pre-set low level, the duty raw sewage pump will start.

Stop

At any time, a low level in the wet well will cause the duty raw sewage pump to shut down (auto or manual).

At any time, a pump may be stopped by placing the H-O-A switch in the off position.

Switching off all pumps may cause alarms to activate on the wet well liquid level.

Backup Float Mode

A backup to the normal control used through the ultrasonic transmitter is available. This is a float system and is identified as a high level start float. Once the level reaches the high level float, the second pump will start automatically. This float is wired to the pump motor starter and the pumps will run at 100 percent speed when activated. This float will be used as a high alarm at the same time. The float will activate when the liquid level reaches 191.709 m.

2.2.5   Bypass Operation

The raw sewage pumps provide the only means for raw sewage to enter the water pollution control plant and are therefore critical to the plant operation and cannot be bypassed.

2.2.6   Instrumentation and Control

The instrumentation in the raw sewage pumping station includes:

*   one (1) ultrasonic level transmitter in the wet well;
*   two (2) float switches, one (1) for high and one for low in the wet well.

Details of the instruments are summarized in the following Tables 2.7 and 2.8

Table 2.7. Level Transmitter Details

Tag Number	LIT-107
Location	Raw Sewage Wet Well
Model	
Range (m)	
Power Supply (V/Hz/ph)	120/60/1

Table 2.8. Float Switch Details

Tag Number	LSL-105, LSL-106
Number of Floats	2
Make	Flygt
Model	ENM-10
Power Supply (V/Hz/ph)	120/60/1

2.2.7   Emergency Provisions

A standby generator will provide power to the raw sewage pumping station during any power failure.

2.2.8   Maintenance

For routine and preventive maintenance and equipment cycling for raw sewage pumps, refer to the manufacturer's operation and maintenance manual.

For specific maintenance requirements and troubleshooting for raw sewage pumps, refer to the manufacturer's operation and maintenance manual.

Prior to carrying out any work on the raw sewage pumps, the operator should:

- place the local disconnect switches at the pump in the off position; and
- place lockout tags on the local disconnect switches.

Influent Peak Flow Summary

Project Name:	Infrastructure Assesment for Growth Plan		**Designed By:** MC		
Project No:	19055		**Date:** 2020-06-16		

Pumping Station Peak Flows

Month	Max (L/s)	Time for Max	Min (L/s)	Time for Min	Avg (L/s)
Jan-20	37.81	11/01/2020 05:00:00 PM	31.79	24/01/2020 01:00:00 AM	34.78
Feb-20	43.85	14/02/2020 06:00:00 AM	0.04	09/02/2020 05:00:00 AM	35.66
Mar-20	39.73	03/03/2020 11:00:00 AM	28.92	03/03/2020 04:00:00 AM	35.59
Apr-20	38.25	15/04/2020 01:00:00 PM	35.24	20/04/2020 02:00:00 PM	36.47
May-20	38.22	20/05/2020 10:00:00 PM	35.32	31/05/2020 06:00:00 AM	37.17
Jun-20					
Jul-20					
Aug-20					
Sep-20					
Oct-20					
Nov-20					
Dec-20					
2020 Maximum	43.85				
2020 Average Max	39.57				
Jan-19	40.84	21/01/2019 02:00:00 PM	26.73	08/01/2019 02:00:00 PM	36.35
Feb-19	40.8	28/02/2019 09:00:00 AM	18.78	25/02/2019 07:00:00 AM	35.42
Mar-19	41.73	08/03/2019 10:00:00 AM	17.05	10/03/2019 01:00:00 PM	36.26
Apr-19	45.67	28/04/2019 12:00:00 PM	13.89	28/04/2019 04:00:00 AM	37.2
May-19	39.25	03/05/2019 12:00:00 PM	35.46	05/05/2019 11:00:00 PM	36.34
Jun-19	38.81	24/06/2019 04:00:00 PM	35.64	04/06/2019 02:00:00 AM	36.68
Jul-19	44.46	18/07/2019 03:00:00 PM	34.43	18/07/2019 03:00:00 AM	36.90
Aug-19	37.43	31/08/2019 05:00:00 PM	34.77	23/08/2019 02:00:00 AM	36.13
Sep-19	41.4	24/09/2019 01:00:00 PM	34.13	07/09/2019 02:00:00 AM	36.48
Oct-19	36.63	25/10/2019 04:00:00 PM	33.32	18/10/2019 02:00:00 AM	35.75
Nov-19	38.38	15/11/2019 10:00:00 AM	22.25	22/11/2019 07:00:00 AM	34.21
Dec-19	43.64	19/12/2019 04:00:00 AM	0.04	19/12/2019 03:00:00 AM	34.79
2019 Max	45.67				
2019 Average	40.75				
Jan-18					
Feb-18	41.40	01/02/2018 03:00:00 PM	35.37	01/02/2018 05:00:00 AM	37.19
Mar-18	38.71	30/03/2018 11:00:00 AM	36.17	03/03/2018 03:00:00 AM	37.42
Apr-18	41.42	22/04/2018 10:00:00 AM	36.35	30/04/2018 11:00:00 PM	38.41
May-18	41.31	21/05/2018 10:00:00 PM	32.76	09/05/2018 02:00:00 AM	35.8
Jun-18	42.87	27/06/2018 08:00:00 AM	35.44	28/06/2018 12:00:00 AM	37.08
Jul-18	37.11	19/07/2018 09:00:00 AM	35.03	18/07/2018 02:00:00 AM	36.34
Aug-18	40.07	02/08/2018 03:00:00 PM	34.77	27/08/2018 04:00:00 AM	36.21
Sep-18	40.47	13/09/2018 09:00:00 AM	35.64	06/09/2018 02:00:00 AM	36.29
Oct-18	37.31	08/10/2018 11:00:00 AM	18.16	16/10/2018 10:00:00 PM	35.79
Nov-18	41.62	30/11/2018 09:00:00 AM	26.16	15/11/2018 01:00:00 PM	35.59
Dec-18	43.73	15/12/2018 05:00:00 PM	35.39	26/12/2018 06:00:00 AM	36.54
2018 Max	43.73				
2018 Average	40.55				
Jan-17					
Feb-17					
Mar-17					
Apr-17					
May-17					
Jun-17					
Jul-17	46.47	20/07/2017 02:00:00 PM	0	21/07/2017 12:00:00 PM	34.94
Aug-17	39.62	22/08/2017 12:00:00 PM	0	05/08/2017 12:00:00 PM	33.07
Sep-17	37.47	07/09/2017 04:00:00 PM	0	02/09/2017 03:00:00 PM	32.79
Oct-17	41.64	05/10/2017 02:00:00 PM	35.22	04/10/2017 02:00:00 AM	36.42
Nov-17	37.55	12/11/2017 10:00:00 AM	35.38	29/11/2017 01:00:00 AM	36.18
Dec-17	41.2	21/12/2017 10:00:00 AM	6.81	26/12/2017 05:00:00 PM	35.84
2017 Max	46.47				
2017 Average	40.66				
Overall Max Flow	46.47				
Overall Avg Flow	40.38				

Appendix B: Sewage Flows

Sewage Flows

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure Assessment		**Designed By:**	MC
Project No:	19055		**Date:**	2020-06-02

Phase 1 - Known Proposed Developments

Design Criteria				
Residential Sewage Flows:	450	L/p/day	A	
No. of Units (Single Family):	589		B	
No. of Persons/Unit (Single Family):	3.0	p/unit	C	
No. of Units (Townhomes):	146		D	
No. of Persons/Unit (Townhomes):	2.4	p/unit	E	
No. of Units (Retirement Homes):	100		F	
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G	
Drainage Area:	58.40	ha	H	
Inflow and Infiltration Rate:	0.28	L/s/ha	I	
Industrial Area:	7.97	ha	J	
Industrial Flow:	0.64	L/s/ha	K	

Calculations

Single Family Residential Sewage Flows

$$F_{SF} = (B \times C)\, A$$
$$= 795150 \quad \text{L/day}$$
$$= 9.20 \quad \text{L/s}$$
$$= 795.15 \quad \text{m}^3\text{/day}$$

Townhome Residential Sewage Flows

$$F_{TH} = (D \times E)\, A$$
$$= 157680 \quad \text{L/day}$$
$$= 1.83 \quad \text{L/s}$$
$$= 157.68 \quad \text{m}^3\text{/day}$$

Retirement Home Sewage Flows

$$F_{RH} = (F \times G)\, A$$
$$= 45000 \quad \text{L/day}$$
$$= 0.52 \quad \text{L/s}$$
$$= 45.00 \quad \text{m}^3\text{/day}$$

Industrial Flows

$$F_{I} = J \times K$$
$$= 5.10 \quad \text{L/s}$$
$$= 440709 \quad \text{L/day}$$
$$= 440.71 \quad \text{m}^3\text{/day}$$

Inflow and Infiltration

$$F_{I\&I} = H \times I$$
$$= 16.35 \quad \text{L/s}$$
$$= 1412813 \quad \text{L/day}$$
$$= 1412.81 \quad \text{m}^3\text{/day}$$

Total Phase 1 Sewage Flows

$$F_{NORWOOD} = F_{SF} + F_{TH} + F_{RH} + F_{I} + F_{I\&I}$$
$$= 2851352 \quad \text{L/day}$$
$$= 33.00 \quad \text{L/s}$$
$$= \mathbf{2851.35} \quad \text{m}^3\text{/day}$$

Sewage Flows

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment   **Designed By:** MC

Project No: 19055   **Date:** 2020-06-02

Phase 2 - Future Developments

Design Criteria			
Residential Sewage Flows:	450	L/p/day	A
No. of Units (Single Family):	267		B
No. of Persons/Unit (Single Family):	3.0	p/unit	C
No. of Units (Townhomes):	0		D
No. of Persons/Unit (Townhomes):	2.4	p/unit	E
No. of Units (Retirement Homes):	80		F
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G
Drainage Area:	23.34	ha	H
Inflow and Infiltration Rate:	0.28	L/s/ha	I

Calculations

Single Family Residential Sewage Flows

$$F_{SF} = (B \times C)\,A$$
$$= 360450 \quad \text{L/day}$$
$$= 4.17 \quad \text{L/s}$$
$$= 360.45 \quad \text{m}^3\text{/day}$$

Townhome Residential Sewage Flows

$$F_{TH} = (D \times E)\,A$$
$$= 0 \quad \text{L/day}$$
$$= 0.00 \quad \text{L/s}$$
$$= 0.00 \quad \text{m}^3\text{/day}$$

Retirement Home Sewage Flows

$$F_{RH} = (F \times G)\,A$$
$$= 36000 \quad \text{L/day}$$
$$= 0.42 \quad \text{L/s}$$
$$= 36.00 \quad \text{m}^3\text{/day}$$

Inflow and Infiltration

$$F_{I\&I} = H \times I$$
$$= 6.54 \quad \text{L/s}$$
$$= 564641 \quad \text{L/day}$$
$$= 564.64 \quad \text{m}^3\text{/day}$$

Total Phase 2 Sewage Flows

$$F_{NORWOOD} = F_{SF} + F_{TH} + F_{RH} + F_{I\&I}$$
$$= 961091 \quad \text{L/day}$$
$$= 11.12 \quad \text{L/s}$$
$$= \mathbf{961.09} \quad \mathbf{m^3\text{/day}}$$

Sewage Flows

Engage Engineering

Project Name: Norwood Infrastructure Assessment	**Designed By:** MC
Project No: 19055	**Date:** 2020-06-02

Phase 3 - Distant Future Developments

Design Criteria			
Residential Sewage Flows:	450	L/p/day	A
No. of Units (Single Family):	962		B
No. of Persons/Unit (Single Family):	3.0	p/unit	C
No. of Units (Townhomes):	20		D
No. of Persons/Unit (Townhomes):	2.4	p/unit	E
No. of Units (Retirement Homes):	0		F
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G
Drainage Area:	70.72	ha	H
Inflow and Infiltration Rate:	0.28	L/s/ha	I

Calculations

Single Family Residential Sewage Flows

$$F_{SF} = (B \times C)\,A$$
$$= 1298700 \quad \text{L/day}$$
$$= 15.03 \quad \text{L/s}$$
$$= 1298.70 \quad \text{m}^3\text{/day}$$

Townhome Residential Sewage Flows

$$F_{TH} = (D \times E)\,A$$
$$= 21600 \quad \text{L/day}$$
$$= 0.25 \quad \text{L/s}$$
$$= 21.60 \quad \text{m}^3\text{/day}$$

Retirement Home Sewage Flows

$$F_{RH} = (F \times G)\,A$$
$$= 0 \quad \text{L/day}$$
$$= 0.00 \quad \text{L/s}$$
$$= 0.00 \quad \text{m}^3\text{/day}$$

Inflow and Infiltration

$$F_{I\&I} = H \times I$$
$$= 19.80 \quad \text{L/s}$$
$$= 1710858 \quad \text{L/day}$$
$$= 1710.86 \quad \text{m}^3\text{/day}$$

Total Phase 2 Sewage Flows

$$F_{NORWOOD} = F_{SF} + F_{TH} + F_{RH} + F_{I\&I}$$
$$= 3031158 \quad \text{L/day}$$
$$= 35.08 \quad \text{L/s}$$
$$= \mathbf{3031.16} \quad \textbf{m}^3\textbf{/day}$$

Appendix C: Wastewater Treatment Plant Capacity
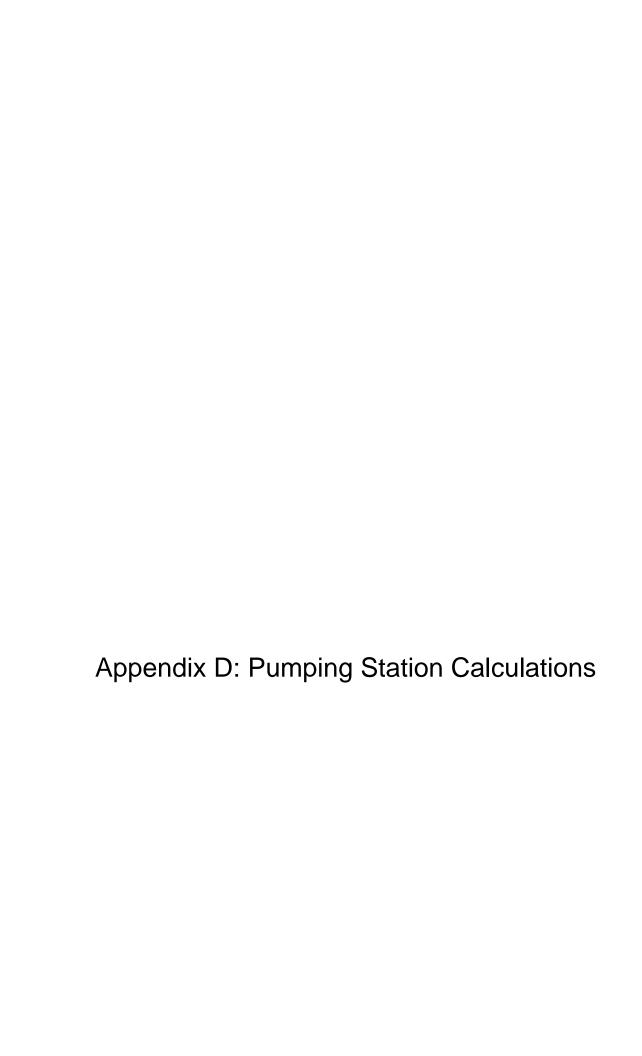
WWTP Available Capacity

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure Assessment		**Designed By:**	MC
Project No:	19055		**Date:**	2020-03-30

Design Criteria			
Residential Sewage Flows:	450	L/p/day	A
No. of Persons/Unit (Single Family):	3.0	p/unit	B
Wastewater Treatment Plant Capacity	1,500	m3/day	C
Existing Flows (to date)	579	m3/day	D
Future Drainage Areas:	152.48	ha	E
No. of Persons in Future Developments:	6,033	p	F
Inflow and Infiltration Rate:	0.28	L/s/ha	G
Calculations			
Residual Capacity			

$$F_{RC} = (C - D)$$
$$= 921 \quad \text{m}^3/\text{day}$$
$$= 921000 \quad \text{L/day} \qquad H$$
$$= 10.7 \quad \text{L/s}$$

Average Infiltration Area

$$A_I = (F / B) / E$$
$$= 13.2 \quad \text{units/ha} \qquad I$$

Number of Units (not considering I&I)

$$U_R = H / (A \times B)$$
$$= 682.22 \quad \text{units} \qquad J$$

Inflow and Infiltration

$$F_{I\&I} = (G / I)$$
$$= 0.02 \quad \text{L/s/unit}$$
$$= 1834 \quad \text{L/day/unit} \qquad K$$
$$= 1.83 \quad \text{m}^3/\text{day/unit}$$

Number of Units

$$U_T = H / (A \times B + K)$$
$$= \mathbf{289} \quad \text{units}$$

Appendix D: Pumping Station Calculations

Pumping Station Available Capacity

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment
Project No: 19055

Designed By: MC
Date: 2020-07-15

Design Criteria				
Residential Sewage Flows:	450	L/p/day	A	
No. of Persons/Unit (Single Family):	3.0	p/unit	B	
Rated Capacity of Pumping Station:	55	L/s	C	
Existing Flows (to date):	46.5	L/s	D	
Future Drainage Areas:	152.48	ha	E	
No. of Persons in Future Developments:	6,033	p	F	
Inflow and Infiltration Rate:	0.28	L/s/ha	G	
Harmon Peaking Factor:	4.50		H	
Calculations				
Residual Capacity				
F_{RC} =	(C - D)			
=	8.6	L/s	I	
Average Infiltration Area				
A_I =	(F / B) / E			
=	13.2	units/ha	J	
Inflow and Infiltration				
$F_{I\&I}$ =	(G / J)			
=	0.02	L/s/unit	K	
=	1834	L/day/unit		
=	1.83	m^3/day/unit		
Number of Units				
U_T =	I / (A x B x H +K)			
=	**94**	units		

Appendix E: Forcemain Calculations

Forcemain Existing Conditions

ENGAGE ENGINEERING

			Designed By:	MC
Project Name: Norwood Infrastructure Assessment			**Date:**	2020-06-22
Project No: 19055				

Velocity

$Q_{existing}$ =   46.5 L/s   737 gpm

D_{ex} =   200 mm

A =   31415.9 mm^2

Velocity: V=Q/A

$V_{existing}$ =   1.5 m/s

Hazen Williams - Friction Loss - Imperial

Existing - 8" Forcemain

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85/d^4.8655)

c=   120

q_e=   737 gpm

d=   7.982 inches

L=   2641 ft

hf =   32.3 ft

hf =   9.9 m

Elevation of forcemain at plant = 199.50

Pump 1 Stop Elevation at PS = 190.759

Head Loss =   8.741 m

Total Loss =   18.6 m

Forcemain Phase 1 Conditions

ENGAGE
ENGINEERING

Project Name: Norwood Infrastructure Assessment	Designed By:	MC
Project No: 19055	Date:	2020-06-22

Velocity

Q_{phase1} =	155.8 L/s	2470 gpm	
D_{ex} =	200 mm		
A =	31415.9 mm^2		

Velocity: V=Q/A

V_{phase1} =   **5.0** m/s

Hazen Williams - Friction Loss - Imperial

Existing - 8" Forcemain

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85/d^4.8655)

c=	120
q_e=	2470 gpm
d=	7.982 inches
L=	2641 ft

hf =	302.9 ft
hf =	**92.3** m

Elevation of forcemain at plant = 199.50

Pump 1 Stop Elevation at PS = 190.759

Head Loss = 8.741 m

Total Loss = **101.0 m**

Forcemain Phase 2 Conditions

| **Project Name: Norwood Infrastructure Assessment** | **Designed By:** | MC |
| **Project No: 19055** | **Date:** | 2020-06-22 |

Velocity

Q_{phase2} =   175.3 L/s   2779 gpm

D_{ex} =   200 mm

A =   31415.9 mm^2

Velocity: V=Q/A

V_{phase2} =   5.6 m/s

Hazen Williams - Friction Loss - Imperial

Existing - 8" Forcemain

$hf = 0.002083 \times L \times (100/C)^{1.85} \times (gpm^{1.85}/d^{4.8655})$

c=   120

q_e=   2779 gpm

d=   7.982 inches

L=   2641 ft

hf =   376.7 ft

hf =   114.8 m

Elevation of forcemain at plant = 199.50

Pump 1 Stop Elevation at PS = 190.759

Head Loss =   8.741 m

Total Loss =   **123.5 m**

Forcemain Phase 3 Conditions

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment			**Designed By:**	MC
Project No: 19055			**Date:**	2020-06-22

Velocity

Q_{phase3} =   236.3 L/s   3745 gpm

D_{ex} =   200 mm

A =   31415.9 mm^2

Velocity: V=Q/A

V_{phase3} =   7.5 m/s

Hazen Williams - Friction Loss - Imperial

Existing - 8" Forcemain

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85/d^4.8655)

c=   120

q_e=   3745 gpm

d=   7.982 inches

L=   2641 ft

hf =   654.1 ft

hf =   199.4 m

Elevation of forcemain at plant = 199.50

Pump 1 Stop Elevation at PS = 190.759

Head Loss =   8.741 m

Total Loss =   208.1 m

Forcemain Future Conditions

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment	**Designed By:** MC
Project No: 19055	**Date:** 2020-06-22

Velocity

$Q_{existing}$ = 46.5 L/s 737 gpm
Q_{future} = 236.3 L/s 3745 gpm
D1 = 375 mm
A1 = 110447 mm2

Velocity: V=Q/A
$V1_{existing}$ = 0.42 m/s
$V1_{future}$ = 2.14 m/s

Hazen Williams - Friction Loss - Imperial

Future - 15" Forcemain
$hf = 0.002083 \times L \times (100/C)^{1.85} \times (gpm^{1.85}/d^{4.8655})$

c= 120
q_f= 3745 gpm
d= 14.43 inches
L= 2641 ft

hf = 36.7 feet
hf = 11.2 m

Elevation of forcemain at plant = 199.50
Pump 1 Stop Elevation at PS = 190.759
Head Loss = 8.741 m

Total Loss = **19.9 m**

Appendix F: Sanitary Sewer Design Sheets

Sanitary Sewer Design Sheet
Existing Conditions

Project Name: Norwood Infrastructure Assessment
Project Number: 19055

Flow Rate: 450 L/person/day
Infiltration: 0.09 L/s/ha
Max Capacity: 80 %
Location: City of Peterborough

Designed By: MC
Date: 2020-02-04

Flow	Type	Value	Unit
Single Family	Residence	2.5	person/unit
Townhomes	Residence	2.4	person/unit
Retirement Home	Residence	1.0	person/unit
Commercial	Peak Flow	0.33	L/s/ha
School	Peak Flow	0.08	L/s/100 Students
Institutional	Peak Flow	0.29	L/s/ha
Fair	Peak Flow	0.29	L/s/1000 attendees

** confirm

Location/Street Name	From Structure	To Structure	Single Family Units	Single Family Pop.	Townhomes Units	Townhomes Pop.	Retirement Units	Retirement Pop.	Commercial Area (ha)	Cumulative Commercial Area (ha)	School Pop.	Cumulative School Pop (Per 100 Students)	Institutional Area (ha)	Cumulative Institutional Area (ha)	Fair Area (ha)	Cumulative Fair Area (ha)	Catchment Area (ha)	Cumulative Catchment Area (ha)	Cumulative Population	Harmon Factor	Residential Peak Flow (L/s)	Commercial Peak Flow (L/s)	School Peak Flow (L/s)	Institutional Peak Flow (L/s)	Fair Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)	Pipe Diameter (mm)	Pipe Slope (%)	Pipe Length (m)	Pipe Material	Mannings 'n'	Velocity in Sewer (m/s)	Pipe Capacity (L/s)	% Capacity	Actual Velocity (m/s)
Murray St	MH10	MH5	12	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	2.057	2.057	30	4.36	0.68	0.00	0.00	0.00	0.00	0.19	0.87	250	0.50	240.5	PVC	0.013	0.86	42.1	2%	0.34
Robert Rd	MH5	MH2A	21	53	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	3.490	5.547	83	4.27	1.83	0.00	0.00	0.00	0.00	0.50	2.33	250	0.50	262.7	PVC	0.013	0.86	42.1	6%	0.46
Pine St	MH2A	MH27	4	10	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.672	6.219	93	4.27	2.06	0.00	0.00	0.00	0.00	0.56	2.61	200	0.40	100.8	PVC	0.013	0.66	20.7	13%	0.45
Ridge St	MH25	MH27	6	15	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.493	1.493	15	4.40	0.34	0.00	0.00	0.00	0.00	0.13	0.48	200	6.30	158.0	PVC	0.013	2.62	82.3	1%	0.69
Ridge St	MH31	MH27	31	78	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	4.609	4.609	78	4.27	1.72	0.00	0.00	0.00	0.00	0.41	2.14	200	0.50	426.0	PVC	0.013	0.74	23.2	9%	0.46
Pine St	MH27	MH16	0	0	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	12.321	185	4.16	4.01	0.00	0.00	0.00	0.00	1.11	5.12	200	0.40	83.0	PVC	0.013	0.66	20.7	25%	0.55
Hwy 7	MH12	MH16	15	38	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	8.981	8.981	38	4.34	0.85	0.00	0.00	0.00	0.00	0.81	1.66	200	0.40	414.0	Concrete	0.013	0.66	20.7	8%	0.39
Hwy7	MH166	MH199	12	30	0	0	0	0	1.438	1.438	0	0	0.000	0.000	0.000	0.000	3.424	3.424	30	4.36	0.68	0.47	0.00	0.00	0.00	0.31	1.46	200	0.40	290.5	Concrete	0.013	0.66	20.7	7%	0.38
Pine St	MH16	MH4	6	15	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.641	21.943	238	4.12	5.10	0.00	0.00	0.00	0.00	1.97	7.07	200	1.00	143.0	Concrete	0.013	1.04	32.8	22%	0.83
Oak St/Spring St	MH2	MH4	10	25	0	0	0	0	0.000	0.000	3	3	0.000	0.000	0.000	0.000	3.914	3.914	25	4.37	0.57	0.00	0.24	0.00	0.00	0.35	1.16	200	0.40	301.0	Concrete	0.013	0.66	20.7	6%	0.36
Spring St	MH4	MH7	23	58	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	0.000	3.066	28.924	320	4.07	6.78	0.00	0.24	0.00	0.00	2.60	9.62	200	0.60	274.5	Concrete	0.013	0.81	25.4	38%	0.75
CR40	MH205	MH201	8	20	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	6.540	6.540	20	4.38	0.46	0.00	0.00	0.00	0.00	0.59	1.04	200	0.70	259.7	Concrete	0.013	0.87	27.4	4%	0.42
Albine Street	MH17A	MH201	125	313	8	19	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	13.970	13.970	332	4.06	7.01	0.00	0.00	0.00		1.26	8.27	200	0.40	167.0	PVC	0.013	0.66	20.7	40%	0.62
CR40	MH201	MH59	193	483	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	23.430	43.940	834	3.85	16.72	0.00	0.00	0.00		3.95	20.68	200	0.70	430.2	PVC	0.013	0.87	27.4	75%	0.96
Wellington		MH59	7	18	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.034	1.034	18	4.39	0.40	0.00	0.00	0.00	0.00	0.09	0.49	200	0.70	105.0	Concrete	0.013	0.87	27.4	2%	0.33
CR40 S		MH59	6	15	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.917	0.917	15	4.40	0.34	0.00	0.00	0.00	0.00	0.08	0.43	200	0.70	99.0	Concrete	0.013	0.87	27.4	2%	0.32
Wellington	MH59	MH111	9	23	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.903	47.795	889	3.83	17.75	0.00	0.00	0.00	0.00	4.30	22.05	375	0.60	272.0	PVC	0.013	1.23	135.8	16%	0.90
Hwy 7		MH111	24	60	0	0	0	0	3.020	3.020	0	0	0.000	0.000	0.000	0.000	20.820	20.820	60	4.30	1.34	1.00	0.00	0.00	0.00	1.87	4.21	200	0.40	604.0	Concrete	0.013	0.66	20.7	20%	0.52
Hwy7	MH111	MH109	2	5	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	1.278	69.893	954	3.81	18.95	1.00	0.00	0.00	0.00	6.29	26.24	375	0.50	147.0	PVC	0.013	1.12	124.0	21%	0.89
Legion St	MH86	MH88	10	25	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	2.277	2.277	25	4.37	0.57	0.00	0.00	0.00	0.00	0.20	0.77	200	0.40	152.0	Concrete	0.013	0.66	20.7	4%	0.31
Cedar St	MH89	MH88	1	3	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.475	0.475	3	4.46	0.06	0.00	0.00	0.00	0.00	0.04	0.10	200	0.40	40.0	Concrete	0.013	0.66	20.7	0%	0.16
Cedar St	MH88	MH90	0	0	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	2.751	28	4.36	0.62	0.00	0.00	0.00	0.00	0.25	0.87	200	0.40	97.0	Concrete	0.013	0.66	20.7	4%	0.32
Cedar St	MH109	MH90	0	0	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	0.440	70.332	954	3.81	18.95	1.00	0.00	0.00	0.00	6.33	26.28	375	0.50	57.0	PVC	0.013	1.12	124.0	21%	0.89
Easement	MH90	MH85	2	5	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	2.503	75.587	987	3.80	19.55	1.00	0.00	0.00	0.00	6.80	27.35	450	0.40	183.0	PVC	0.013	1.13	180.3	15%	0.82
Elm St	MH82	MH85	3	8	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.908	0.908	8	4.43	0.17	0.00	0.00	0.00	0.00	0.08	0.25	200	0.70	128.0	Concrete	0.013	0.87	27.4	1%	0.27
Easement	MH85	MH106	1	3	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	0.537	77.031	997	3.80	19.73	1.00	0.00	0.00	0.00	6.93	27.66	450	0.30	115.0	PVC	0.013	0.98	156.2	18%	0.74
Hwy7	MH23	MH21	4	10	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.929	0.929	10	4.42	0.23	0.00	0.00	0.00	0.00	0.08	0.31	200	0.60	160.0	Concrete	0.013	0.81	25.4	1%	0.28
CR40	MH123	MH21	3	8	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.683	0.683	8	4.43	0.17	0.00	0.00	0.00	0.00	0.06	0.23	200	9.20	102.0	Concrete	0.013	3.17	99.5	0%	0.61
Hwy7	MH19	MH21	4	10	0	0	0	0	0.590	0.590	0	0	0.000	0.000	0.000	0.000	1.543	1.543	10	4.42	0.23	0.19	0.00	0.00	0.00	0.14	0.56	200	1.60	161.0	Concrete	0.013	1.32	41.5	1%	0.46
Victoria	MH21	MH106	0	0	0	0	0	0	0.000	0.590	0	0	0.000	0.000	0.000	0.000	0.250	3.405	28	4.36	0.62	0.19	0.00	0.00	0.00	0.31	1.13	200	1.60	103.0	Concrete	0.013	1.32	41.5	3%	0.57
Victoria	MH106	MH33	4	10	0	0	0	0	0.066	3.676	0	0	0.000	0.000	0.000	0.000	2.213	82.649	1034	3.79	20.42	1.21	0.00	0.00	0.00	7.44	29.07	450	0.50	182.0	PVC	0.013	1.27	201.6	14%	0.90
CR45	MH199	MH7	0	0	0	0	0	0	0.668	2.106	0	0	0.000	0.000	0.000	0.000	1.114	4.538	30	4.36	0.68	0.70	0.00	0.00	0.00	0.41	1.78	200	1.00	144.0	Concrete	0.013	1.04	32.8	5%	0.56
CR45	MH7	MH33	0	0	0	0	0	0	0.268	2.375	0	3	0.000	0.000	0.000	0.000	0.672	34.134	350	4.05	7.38	0.78	0.24	0.00	0.00	3.07	11.48	200	1.00	91.0	Concrete	0.013	1.04	32.8	35%	0.95
Pumping Station	MH33	MH124	0	0	0	0	0	0	0.000	6.051	0	3	0.000	0.000	0.000	0.000	0.000	116.782	1384	3.71	26.71	2.00	0.24	0.00	0.00	10.51	39.46	250	0.80	10.5	Concrete	0.013	1.08	53.2	74%	1.19
Queen Street	MH36	MH41	52	130	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	7.221	7.221	130	4.21	2.85	0.00	0.00	0.00	0.00	0.65	3.50	200	0.40	565.0	Concrete	0.013	0.66	20.7	17%	0.49
King Street	MH100	MH101	9	23	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.482	1.482	23	4.37	0.51	0.00	0.00	0.00	0.00	0.13	0.65	200	1.14	95.0	Concrete	0.013	1.11	35.0	2%	0.43
King Street	MH101	MH102	10	25	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.952	2.434	48	4.32	1.07	0.00	0.00	0.00	0.00	0.22	1.29	200	0.44	89.3	Concrete	0.013	0.69	21.8	6%	0.38
King Street	MH102	MH103	8	20	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.951	3.384	68	4.29	1.51	0.00	0.00	0.00	0.00	0.30	1.81	200	1.53	85.3	Concrete	0.013	1.29	40.6	4%	0.65
King Street	MH103	MH104	9	23	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.949	4.333	90	4.26	2.00	0.00	0.00	0.00	0.00	0.39	2.38	200	0.65	92.7	Concrete	0.013	0.84	26.4	9%	0.52
King Street	MH104	MH105	6	15	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.878	5.212	105	4.24	2.32	0.00	0.00	0.00	0.00	0.47	2.79	200	0.55	92.0	Concrete	0.013	0.77	24.3	11%	0.51
Elm Street	MH80	MH105	0	0	0	0	0	0	0.000	0.000	3	3	0.000	0.000	10.000	10.000	21.451	21.451	0	4.50	0.00	0.00	0.24	2.90	1.93	5.07	200	0.50	321.0	Concrete	0.013	0.74	23.2	22%	0.59
Alma Street	MH74	MH54	22	55	0	0	0	0	61	61	0	0	0.000	0.000	0.000	0.000	6.508	6.508	116	4.23	2.55	0.00	0.00	0.00	0.00	0.59	3.14	200	0.40	484.1	Concrete	0.013	0.66	20.7	15%	0.48
King Street	MH54	MH105	10	25	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.703	8.211	141	4.20	3.08	0.00	0.00	0.00	0.00	0.74	3.82	200	0.60	179.3	Concrete	0.013	0.81	25.4	15%	0.58
Elm Street	MH105	MH41	0	0	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	10.000	0.180	35.054	246	4.11	5.27	0.00	0.24	2.90	3.15	11.57	200	0.50	98.2	Concrete	0.013	0.74	23.2	50%	0.74
Queen Street	MH41	MH42	10	25	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	10.000	1.105	43.380	401	4.02	8.40	0.00	0.24	2.90	3.90	15.44	200	0.40	86.1	Concrete	0.013	0.66	20.7	74%	0.73
Queen Street	MH42	MH43	8	20	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	10.000	0.912	44.292	421	4.01	8.80	0.00	0.24	2.90	3.99	15.92	200	0.40	93.3	Concrete	0.013	0.66	20.7	77%	0.73
Queen Street	MH43	MH44	6	15	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	10.000	0.955	45.247	436	4.00	9.09	0.00	0.24	2.90	4.07	16.30	200	0.40	83.3	Concrete	0.013	0.66	20.7	79%	0.73
Queen Street	MH44	MH45	2	5	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	10.000	0.357	45.604	441	4.00	9.19	0.00	0.24	2.90	4.10	16.44	200	0.40	72.2	Concrete	0.013	0.66	20.7	79%	0.73
King Street	MH55	MH56	12	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	1.522	1.522	30	4.36	0.68	0.00	0.00	0.00	0.00	0.14	0.82	200	0.60	161.0	Concrete	0.013	0.81	25.4	3%	0.37
Flora Street	MH56		12	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	3.462	3.462	30	4.36	0.68	0.00	0.26	0.00	0.00	0.31	1.25	250	0.40	235.0	Concrete	0.013	0.77	37.6	3%	0.35
Flora Street	MH56	MH45	3	8	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	0.000	0.408	5.392	68	4.29	1.51	0.00	0.26	0.00	0.00	0.49	2.25	200	0.40	102.0	Concrete	0.013	0.66	20.7	11%	0.43
Queen Street	MH45	MH166	0	0	0	0	0	0	0.000	0.000	0	6	0.000	0.000	0.000	10.000	0.000	50.996	509	3.97	10.51	0.00	0.50	2.90	4.59	18.50	200	0.40	14.2	Concrete	0.013	0.66	20.7	89%	0.75
Birch Street		MH97	89	223	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	5.545	5.545	223	4.13	4.79	0.00	0.00	0.00	0.00	0.50	5.29	200	0.40	702.5	Concrete	0.013	0.66	20.7	25%	0.55
Victoria	MH97	MH101	24	60	0	0	0	0	60	60	0	0	0.000	0.000	0.000	0.000	6.989	12.534	343	4.05	7.23	0.00	0.00	0.00	0.00	1.13	8.36	200	0.60	702.5	Concrete	0.013	0.81	25.4	33%	0.72
Victoria	MH101	MH166	16	40	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	5.045	19.060	405	4.02	8.48	0.00	0.00	0.00	0.00	1.72	10.20	200	0.50	348.0	Concrete	0.013	0.74	23.2	44%	0.71
Pumping Station	MH166	MH124	0	0	0	0	0	0	0.000	0.000	0	6	0.000	0.000	0.000	10.000	0.604	70.661	914	3.83	18.20	0.00	0.50	2.90	6.36	27.96	250	1.00	112.1	Concrete	0.013	1.21	59.5	47%	1.19
	MH124	PS	0	0	0	0	0	0	0.000	6.051	0	9	0.000	0.000	0.000	10.000	0.000	187.443	2298	3.54	42.34	2.00	0.74	0.00	2.90	16.87	64.85	250	1.40	6.3	Concrete	0.013	1.43	70.4	92%	1.63

assumed
upgraded for PH.3

Sanitary Sewer Design Sheet
Future Conditions

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment
Project Number: 19055

Flow Rate: 450 L/person/day
Infiltration: 0.28 L/s/ha
Max Capacity: 80 %
Location: City of Peterborough

Designed By: MC
Date: 2020-02-04

Flow	Type	Value	Unit
Single Family	Residence	3.0	person/unit
Townhomes	Residence	2.4	person/unit
Retirement Home	Residence	1.0	person/unit
Commercial	Peak Flow	0.33	L/s/ha
School	Peak Flow	0.08	L/s/100 Students
Institutional	Peak Flow	0.29	L/s/ha
Fair	Peak Flow	0.29	L/s/1000 attendees
Industrial	Peak Flow	0.64	L/s

Columns: Location/Street Name, From Structure, To Structure | Single Family (Units, Pop) | Townhomes (Units, Pop) | Retirement Home (Units, Pop) | Commercial (Area ha, Cum ha) | School (Pop, Cum /100) | Institutional (Area ha, Cum ha) | Fair (Area ha, Cum ha) | Industrial (Area ha, Cum ha) | Area (Catchment ha, Cum ha) | Population (Cum Pop, Harmon Factor) | Flow (Res Peak, Comm Peak, School Peak, Inst Peak, Fair Peak, Ind Peak, Infiltration, Total Peak — all L/s) | Pipe (Dia mm, Slope %, Length m, Material, Manning's n) | Hydraulics (Velocity m/s, Pipe Cap L/s, % Cap, Actual Velocity m/s)

Loc	From	To	SF U	SF Pop	TH U	TH Pop	RH U	RH Pop	Comm A	Cum Comm	Sch Pop	Cum Sch	Inst A	Cum Inst	Fair A	Cum Fair	Ind A	Cum Ind	Catch A	Cum Catch	Cum Pop	Harmon	Res Pk	Comm Pk	Sch Pk	Inst Pk	Fair Pk	Ind Pk	Infil	Total Pk	Dia	Slope	Length	Matl	n	Vel	Cap	%Cap	Act Vel
Murray St		MH10	46	138	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	6.080	6.080	138	4.20	3.02	0.00	0.00	0.00	0.00	0.00	1.70	4.72	200	0.50	100.0	PVC	0.013	0.74	23.2	20%	0.58
Murray St	MH10	MH5	12	36	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	2.057	8.137	174	4.17	3.78	0.00	0.00	0.00	0.00	0.00	2.28	6.06	250	0.50	240.5	PVC	0.013	0.86	42.1	14%	0.61
Robert Rd		MH5	215	645	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	15.380	15.380	645	3.92	13.15	0.00	0.00	0.00	0.00	0.00	4.31	17.46	200	0.70	100.0	PVC	0.013	0.87	27.4	64%	0.92
Robert Rd	MH5	MH2A	21	63	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	3.490	27.007	882	3.83	17.61	0.00	0.00	0.00	0.00	0.00	7.56	25.17	250	0.50	262.7	PVC	0.013	0.86	42.1	60%	0.89
Pine St	MH2A	MH27	4	12	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.672	27.679	894	3.83	17.85	0.00	0.00	0.00	0.00	0.00	7.75	25.60	250	0.50	100.8	PVC	0.013	0.77	37.6	68%	0.82
Ridge St	MH25	MH27	6	18	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.493	1.493	18	4.39	0.41	0.00	0.00	0.00	0.00	0.00	0.42	0.83	200	6.30	158.0	PVC	0.013	2.62	82.3	1%	0.83
Ridge St	MH31	MH27	31	93	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	4.609	4.609	93	4.25	2.06	0.00	0.00	0.00	0.00	0.00	1.29	3.35	200	0.50	426.0	PVC	0.013	0.74	23.2	14%	0.52
Pine St	MH27	MH16	0	0	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33.781	1005	3.80	19.89	0.00	0.00	0.00	0.00	0.00	9.46	29.34	300	0.40	83.0	PVC	0.013	0.87	61.2	48%	0.86
Hwy 7	MH12	MH16	15	45	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	8.981	8.981	45	4.32	1.01	0.00	0.00	0.00	0.00	0.00	2.51	3.53	200	0.40	414.0	Concrete	0.013	0.66	20.7	17%	0.49
Hwy7	MH166	MH199	12	36	0	0	0	0	1.438	1.438	0	0	0.000	0.000	0.000	0.000	0.000	0.000	3.424	3.424	36	4.34	0.81	0.47	0.00	0.00	0.00	0.00	0.96	2.25	200	0.40	290.5	Concrete	0.013	0.66	20.7	11%	0.43
Pine St	MH16	MH4	6	18	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.641	43.403	1068	3.78	21.03	0.00	0.00	0.00	0.00	0.00	12.15	33.18	250	1.00	143.0	Concrete	0.013	1.21	59.5	56%	1.24
Oak St/Spring St	MH2	MH4	10	30	0	0	0	0	0.000	0.000	3	3	0.000	0.000	0.000	0.000	0.000	0.000	3.914	3.914	30	4.36	0.68	0.00	0.24	0.00	0.00	0.00	1.10	2.02	200	0.40	301.0	Concrete	0.013	0.66	20.7	10%	0.42
Spring St	MH4	MH7	23	69	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	0.000	0.000	0.000	3.066	50.384	1167	3.76	22.83	0.00	0.24	0.00	0.00	0.00	14.11	37.18	300	0.60	274.5	Concrete	0.013	1.06	74.9	50%	1.06
CR40		MH205	221	663	0	0	80	80	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	17.280	17.280	743	3.88	15.01	0.00	0.00	0.00	0.00	0.00	4.84	19.85	250	0.70	100.0	PVC	0.013	1.01	49.8	40%	0.95
CR40	MH205	MH201	8	24	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	6.540	23.820	767	3.87	15.46	0.00	0.00	0.00	0.00	0.00	6.67	22.13	250	1.00	259.7	Concrete	0.013	1.04	32.8	67%	1.12
Albine Street		MH17A	273	819	8	19	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	19.480	19.480	838	3.85	16.80	0.00	0.00	0.00	0.00	0.00	5.45	22.25	250	0.50	100.0	PVC	0.013	0.86	42.1	53%	0.87
Albine Street	MH17A	MH201	125	375	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	13.970	33.450	1213	3.74	23.66	0.00	0.00	0.00	0.00	0.00	9.37	33.02	300	0.40	167.0	PVC	0.013	0.87	61.2	54%	0.88
CR40	MH201	MH59	193	579	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	23.430	80.700	2559	3.50	46.65	0.00	0.00	0.00	0.00	0.00	22.60	69.25	375	0.50	430.0	Concrete	0.013	1.33	146.7	47%	1.31
Wellington		MH59	35	105	20	48	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	4.530	4.530	153	4.19	3.34	0.00	0.00	0.00	0.00	0.00	1.27	4.61	200	0.50	100.0	PVC	0.013	0.74	23.2	20%	0.57
Wellington		MH59	7	21	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.034	1.034	21	4.38	0.48	0.00	0.00	0.00	0.00	0.00	0.29	0.77	200	0.70	105.0	Concrete	0.013	0.87	27.4	3%	0.38
CR40 S		MH59	6	18	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.917	0.917	18	4.39	0.41	0.00	0.00	0.00	0.00	0.00	0.26	0.67	200	0.70	99.0	Concrete	0.013	0.87	27.4	2%	0.36
Wellington	MH59	MH111	9	27	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.903	89.085	2778	3.47	50.22	0.00	0.00	0.00	0.00	0.00	24.94	75.17	375	0.60	272.0	PVC	0.013	1.23	135.8	55%	1.26
Hwy 7		MH111	24	72	0	0	0	0	3.020	3.020	0	0	0.000	0.000	0.000	0.000	0.000	0.000	20.820	20.820	72	4.28	1.61	1.00	0.00	0.00	0.00	0.00	5.83	8.43	200	0.40	604.0	Concrete	0.013	0.66	20.7	41%	0.63
Hwy7	MH111	MH109	2	6	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.278	111.183	2856	3.46	51.47	1.00	0.00	0.00	0.00	0.00	31.13	83.60	375	0.50	147.0	PVC	0.013	1.12	124.0	67%	1.20
Legion St	MH86	MH88	10	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	2.277	2.277	33	4.35	0.68	0.00	0.00	0.00	0.00	0.00	0.64	1.32	200	0.40	152.0	Concrete	0.013	0.66	20.7	6%	0.37
Cedar St	MH89	MH88	1	3	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.475	0.475	3	4.45	0.07	0.00	0.00	0.00	0.00	0.00	0.13	0.20	200	0.40	40.0	Concrete	0.013	0.66	20.7	1%	0.21
Cedar St	MH88	MH90	0	0	0	0	0	0	0.000	0.000	0	3.020	0.000	0.000	0.000	0.000	0.000	0.000	0.440	2.751	33	4.35	0.75	0.00	0.00	0.00	0.00	0.00	0.77	1.52	200	0.40	97.0	Concrete	0.013	0.66	20.7	7%	0.38
Cedar St	MH109	MH90	0	0	0	0	0	0	0.000	3.020	0	0	0.000	0.000	0.000	0.000	0.000	0.000	11.622	116.622	2856	3.46	51.47	1.00	0.00	0.00	0.00	0.00	31.25	83.72	375	0.50	57.0	PVC	0.013	1.12	124.0	68%	1.20
Easement	MH90	MH85	2	6	0	0	0	0	0.720	3.740	0	0	0.000	0.000	0.000	0.000	0.000	0.000	2.503	116.8777	2895	3.46	52.10	1.23	0.00	0.00	0.00	0.00	32.73	86.06	450	0.50	183.0	PVC	0.013	1.13	180.3	48%	1.12
Elm St	MH82	MH85	3	9	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.908	0.908	9	4.42	0.21	0.00	0.00	0.00	0.00	0.00	0.25	0.46	200	0.70	128.0	Concrete	0.013	0.87	27.4	2%	0.32
Easement	MH85	MH106	1	3	0	0	0	0	0.000	3.740	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.537	118.321	2907	3.45	52.30	1.23	0.00	0.00	0.00	0.00	33.13	86.66	450	0.30	115.0	PVC	0.013	0.98	156.2	55%	1.01
Hwy7	MH23	MH21	4	12	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.929	0.929	12	4.41	0.28	0.00	0.00	0.00	0.00	0.00	0.26	0.54	200	0.40	160.0	Concrete	0.013	0.66	20.7	2%	0.32
CR40	MH123	MH21	3	9	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.683	0.683	9	4.42	0.21	0.00	0.00	0.00	0.00	0.00	0.19	0.40	200	9.20	102.0	Concrete	0.013	3.17	99.5	0%	0.73
Hwy7	MH19	MH21	4	12	0	0	0	0	0.590	0.590	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.543	1.543	12	4.41	0.28	0.19	0.00	0.00	0.00	0.00	0.43	0.90	200	1.60	161.0	Concrete	0.013	1.32	41.5	2%	0.53
Victoria	MH21	MH106	0	0	0	0	0	0	0.000	0.590	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.250	3.405	33	4.35	0.75	0.19	0.00	0.00	0.00	0.00	0.95	1.90	200	1.60	103.0	Concrete	0.013	1.32	41.5	5%	0.67
Victoria	MH106	MH33	4	12	0	0	0	0	0.066	4.396	0	0	0.000	0.000	0.000	0.000	0.000	0.000	2.213	123.939	2952	3.45	53.02	1.45	0.00	0.00	0.00	0.00	34.70	89.17	450	0.50	182.0	PVC	0.013	1.27	201.6	44%	1.23
CR45	MH199	MH7	0	0	0	0	0	0	0.668	2.106	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.114	4.538	36	4.34	0.81	0.70	0.00	0.00	0.00	0.00	1.27	2.78	200	1.00	144.0	Concrete	0.013	1.04	32.8	8%	0.63
CR45	MH7	MH33	0	0	0	0	0	0	0.268	2.375	0	3	0.000	0.000	0.000	0.000	0.000	0.000	0.672	55.594	1203	3.75	23.48	0.78	0.24	0.00	0.00	0.00	15.57	40.07	250	1.00	91.0	Concrete	0.013	1.21	59.5	67%	1.30
Pumping Station	MH33	MH124	0	0	0	0	0	0	0.000	6.771	0	3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	179.533	4155	3.32	71.81	2.23	0.24	0.00	0.00	0.00	50.27	124.55	450	0.80	10.5	Concrete	0.013	1.60	255.0	49%	1.59
Queen Street	MH36	MH41	52	156	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	7.221	7.221	156	4.19	3.40	0.00	0.00	0.00	0.00	0.00	2.02	5.42	200	0.40	565.0	Concrete	0.013	0.66	20.7	26%	0.55
King Street	MH100	MH101	9	27	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.482	1.482	27	4.36	0.61	0.00	0.00	0.00	0.00	0.00	0.41	1.03	200	1.14	95.0	Concrete	0.013	1.11	35.0	3%	0.49
King Street	MH101	MH102	10	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.952	2.434	57	4.30	1.28	0.00	0.00	0.00	0.00	0.00	0.68	1.96	200	0.44	89.3	Concrete	0.013	0.69	21.8	9%	0.43
King Street	MH102	MH103	8	24	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.951	3.384	81	4.27	1.80	0.00	0.00	0.00	0.00	0.00	0.95	2.75	200	1.53	85.3	Concrete	0.013	1.29	40.6	7%	0.58
King Street	MH103	MH104	9	27	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.949	4.333	108	4.23	2.38	0.00	0.00	0.00	0.00	0.00	1.21	3.59	200	0.65	92.7	Concrete	0.013	0.84	26.4	14%	0.59
King Street	MH104	MH105	6	18	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.878	5.212	126	4.22	2.77	0.00	0.00	0.00	0.00	0.00	1.46	4.23	200	0.50	92.0	Concrete	0.013	0.77	24.3	17%	0.58
Elm Street		MH80	363	1089	146	350	100	100	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	31.510	31.510	1539	3.67	29.43	0.00	0.00	0.00	0.00	0.00	8.82	38.26	300	0.50	100.0	PVC	0.013	0.97	68.4	56%	0.99
Elm Street	MH80	MH105	0	0	0	0	0	0	0.000	0.000	3	3	10.000	10.000	0.000	0.000	0.000	0.000	21.451	52.961	1539	3.67	29.43	0.00	0.24	2.90	0.00	0.00	14.83	47.40	300	0.50	321.0	Concrete	0.013	0.83	68.4	69%	1.04
Alma Street		MH74	108	324	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	7.720	7.720	324	4.06	6.86	0.00	0.00	0.00	0.00	0.00	2.16	9.02	200	0.50	100.0	PVC	0.013	0.74	23.2	39%	0.69
Alma Street	MH74	MH54	22	66	0	0	93	93	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	6.508	14.228	483	3.98	10.02	0.00	0.00	0.00	0.00	0.00	3.98	14.00	200	0.40	484.1	Concrete	0.013	0.66	20.7	67%	0.71
King Street	MH54	MH105	10	30	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.703	15.931	513	3.97	10.60	0.00	0.00	0.00	0.00	0.00	4.46	15.06	200	0.60	179.3	Concrete	0.013	0.81	25.4	59%	0.84
Elm Street	MH105	MH41	0	0	0	0	0	0	0.000	0.000	0	0	10.000	10.000	0.000	0.000	0.000	0.000	0.180	74.284	2178	3.56	40.36	0.00	0.00	2.90	0.00	0.00	20.80	64.30	375	0.40	52.0	PVC	0.013	1.12	124.0	52%	1.13
Queen Street	MH41	MH42	10	30	0	0	0	0	0.000	0.000	0	3	0.000	10.000	0.000	0.000	0.000	0.000	1.105	82.610	2364	3.53	43.45	0.00	0.24	2.90	0.00	0.00	23.13	69.72	375	0.40	86.1	Concrete	0.013	1.00	110.9	63%	1.06
Queen Street	MH42	MH43	8	24	0	0	0	0	0.000	0.000	0	3	0.000	10.000	0.000	0.000	0.000	0.000	0.912	83.522	2388	3.53	43.85	0.00	0.24	2.90	0.00	0.00	23.39	70.38	375	0.40	93.3	Concrete	0.013	1.00	110.9	64%	1.06
Queen Street	MH43	MH44	6	18	0	0	0	0	0.000	0.000	0	3	0.000	10.000	0.000	0.000	0.000	0.000	0.955	84.477	2406	3.52	44.14	0.00	0.24	2.90	0.00	0.00	23.65	70.94	375	0.40	83.3	Concrete	0.013	1.00	110.9	64%	1.06
Queen Street	MH44	MH45	2	6	0	0	0	0	0.000	0.000	0	3	0.000	10.000	0.000	0.000	0.000	0.000	0.357	84.834	2412	3.52	44.24	0.00	0.24	2.90	0.00	0.00	23.75	71.13	375	0.40	72.2	Concrete	0.013	1.00	110.9	64%	1.06
King Street	MH55	MH56	12	36	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	1.522	1.522	36	4.34	0.81	0.00	0.00	0.00	0.00	0.00	0.43	1.24	200	0.60	161.0	Concrete	0.013	0.81	25.4	5%	0.42
Flora Street		MH56	12	36	0	0	0	0	0.000	0.000	3	3	0.000	0.000	0.000	0.000	0.000	0.000	3.462	3.462	36	4.34	0.81	0.00	0.24	0.00	0.00	0.00	0.97	2.04	250	0.40	235.0	Concrete	0.013	0.66	37.6	5%	0.49
Flora Street	MH56	MH45	3	9	0	0	0	0	0.000	0.000	0	3	0.000	0.000	0.000	0.000	0.000	0.000	0.408	5.392	81	4.27	1.80	0.00	0.24	0.00	0.00	0.00	1.51	3.57	200	0.40	102.0	Concrete	0.013	0.66	20.7	17%	0.49
Queen Street	MH45	MH166	0	0	0	0	0	0	0.000	0.000	0	6	0.000	10.000	0.000	0.000	0.000	0.000	0.000	90.226	2493	3.51	45.57	0.00	0.50	2.90	0.00	0.00	25.26	74.23	375	0.60	90.0	Concrete	0.013	1.23	124.0	—	1.08
CR42	New	MH97	439	1317	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	31.330	31.330	1317	3.72	25.52	0.00	0.00	0.00	0.00	0.00	8.77	34.29	300	0.50	1360.0	PVC	0.013	0.97	68.4	50%	0.97
Birch Street		MH97	89	267	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	5.545	5.545	267	4.10	5.70	0.00	0.00	0.00	0.00	0.00	1.55	7.25	200	0.40	702.5	Concrete	0.013	0.66	20.7	35%	0.60
Industrial Drive		MH101	0	0	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	7.970	7.970	7.970	7.970	0	4.50	0.00	0.00	0.00	0.00	0.00	5.10	2.23	7.33	200	0.70	270.0	PVC	0.013	0.74	23.2	32%	0.65
Victoria	MH97	MH101	24	72	0	0	72	72	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	7.970	6.989	43.864	1728	3.63	32.71	0.00	0.00	0.00	0.00	5.10	12.28	44.99	300	0.50	702.5	Concrete	0.013	1.06	74.9	60%	1.11
Victoria	MH101	MH166	16	48	0	0	0	0	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	7.970	5.045	58.360	1803	3.62	33.99	0.00	0.00	0.00	0.00	5.10	16.34	55.44	375	0.50	348.0	Concrete	0.013	1.12	124.0	45%	1.09
Pumping Station	MH166	MH124	0	0	0	0	0	0	0.000	0.000	0	6	0.000	10.000	0.000	0.000	0.000	7.970	0.604	149.191	4296	3.51	41.77	0.00	0.50	2.90	0.00	5.10	41.77	124.23	450	0.60	112.1	Concrete	0.013	1.79	285.1	44%	1.73
	MH124	PS	0	0	0	0	0	0	0.000	6.771	0	9	0.000	10.000	0.000	0.000	0.000	7.970	0.000	328.723	8452	3.03	133.24	2.23	0.74	2.90	0.00	5.10	92.04	236.26	675	0.60	6.3	Concrete	0.013	1.82	651.2	36%	1.67

Legend:
- Yellow — Assumed
- Green — Upgraded for Norwood Park PH.3
- Future Development
- Upgraded for Future Development

Notes:
1. Phase A at 2291 County Road 45 connected into Alma Street. Phase B at 2291 County Road 45 and the development at 1552 County Road 42 has been assumed to be serviced via a new sewer on County Road 42 and connecting into Victoria Street. Alternate option would be to connect these flows into Alma Street which impacts upgrades required.
2. All flows are directed to the Lions Park pumping station and pumped to the wastewater treatment plant as there is currently no gravity inlet in to WWTP. Township should investigate feasibility of gravity inlet to plant which would impact sewer upgrades.

Appendix G: Water Demand Calculations

Water Demand

Project Name: Norwood Infrastructure
Project No: 19055

Designed By: MC
Date: 2020-06-02

Phase 1 - Known Proposed Developments

Design Criteria			
Domestic Water Demand:	450	L/p/day	A
No. of Units (Single Family):	589		B
No. of Persons/Unit (Single Family):	3.0	p/unit	C
No. of Units (Townhomes)	146		D
No. of Persons/Unit (Townhomes):	2.4	p/unit	E
No. of Units (Retirement Home):	100		F
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G
Max. Day Peak Factor (MOE):	2.00		H
Peak Hour Peak Factor (MOE):	3.00		I
Fire Flow:	2,000	L/min	J
Industrial Area:	7.97	ha	K
Industrial Water Demand:	0.64	l/s/ha	L

Calculations

Average Day Demand

$$Q_{AVG} = A \times (B \times C + D \times E + F \times G)$$

=	1438539	L/day
=	999.0	L/min
=	1438.5	m³/day

Maximum Day Demand

$$Q_{MDD} = Q_{AVG} \times H$$

=	2877078	L/day
=	1998.0	L/min
=	2877.1	m³/day

Peak Hour Demand

$$Q_{PHD} = Q_{AVG} \times I$$

=	4315617	L/day
=	2997.0	L/min
=	4315.6	m³/day

Total Demand (MDD + Fire Flow)

$$Q_{TD} = Q_{MDD} + J$$

=	5757078	L/day
=	3998.0	L/min
=	**5757.1**	**m³/day**

Water Demand

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure	**Designed By:**	MC
Project No:	19055	**Date:**	2020-06-02

Phase 2 - Future Developments

Design Criteria			
Domestic Water Demand:	450	L/p/day	A
No. of Units (Single Family):	267		B
No. of Persons/Unit (Single Family):	3.0	p/unit	C
No. of Units (Townhomes)	0		D
No. of Persons/Unit (Townhomes):	2.4	p/unit	E
No. of Units (Retirement Home):	80		F
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G
Max. Day Peak Factor (MOE):	2.00		H
Peak Hour Peak Factor (MOE):	3.00		I
Fire Flow:	2,000	L/min	J

Calculations			

Average Day Demand

$$Q_{AVG} = A \times (B \times C + D \times E + F \times G)$$

=	396450	L/day
=	275.3	L/min
=	396.5	m³/day

Maximum Day Demand

$$Q_{MDD} = Q_{AVG} \times H$$

=	792900	L/day
=	550.6	L/min
=	792.9	m³/day

Peak Hour Demand

$$Q_{PHD} = Q_{AVG} \times I$$

=	1189350	L/day
=	825.9	L/min
=	1189.4	m³/day

Total Demand (MDD + Fire Flow)

$$Q_{TD} = Q_{MDD} + J$$

=	3672900	L/day
=	2550.6	L/min
=	**3672.9**	**m³/day**

Water Demand
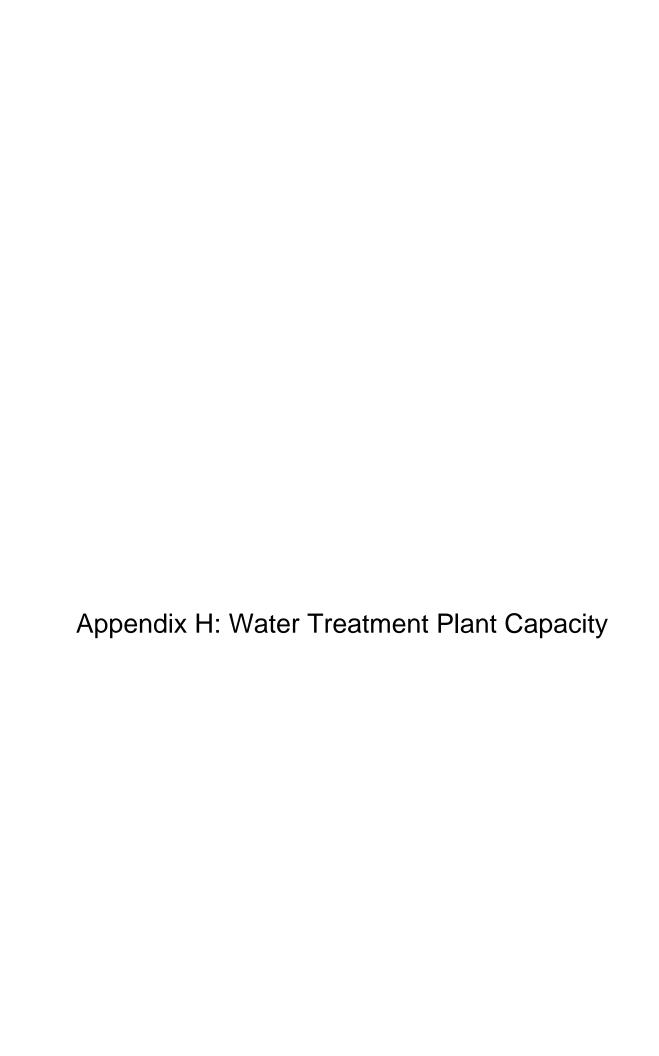
ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure	**Designed By:**	MC
Project No:	19055	**Date:**	2020-06-02

Phase 3 - Distant Future Developments

Design Criteria			
Domestic Water Demand:	450	L/p/day	A
No. of Units (Single Family):	962		B
No. of Persons/Unit (Single Family):	3.0	p/unit	C
No. of Units (Townhomes)	20		D
No. of Persons/Unit (Townhomes):	2.4	p/unit	E
No. of Units (Retirement Home):	0		F
No. of Persons/Unit (Retirement Home):	1.0	p/unit	G
Max. Day Peak Factor (MOE):	2.00		H
Peak Hour Peak Factor (MOE):	3.00		I
Fire Flow:	2,000	L/min	J

Calculations			

Average Day Demand

Q_{AVG}	=	$A \times (B \times C + D \times E + F \times G)$	
	=	1320300	L/day
	=	916.9	L/min
	=	1320.3	m³/day

Maximum Day Demand

Q_{MDD}	=	$Q_{AVG} \times H$	
	=	2640600	L/day
	=	1833.8	L/min
	=	2640.6	m³/day

Peak Hour Demand

Q_{PHD}	=	$Q_{AVG} \times I$	
	=	3960900	L/day
	=	2750.6	L/min
	=	3960.9	m³/day

Total Demand (MDD + Fire Flow)

Q_{TD}	=	$Q_{MDD} + J$	
	=	5520600	L/day
	=	3833.8	L/min
	=	**5520.6**	**m³/day**

Appendix H: Water Treatment Plant Capacity

WTP Available Capacity

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure Assessment	**Designed By:**	MC
Project No:	19055	**Date:**	2020-03-30

Design Criteria			
Domestic Water Demand:	450	L/p/day	A
No. of Persons/Unit (Single Family):	3.0	p/unit	B
Water Treatment Plant Capacity:	1,965	m3/day	C
Average Maximum Daily Flow:	1,003	m3/day	D
Max. Day Peak Factor (MOE):	2.00		E
Peak Hour Peak Factor (MOE):	3.00		F
Calculations			
Residual Capacity			

$$F_{RC} = (C - D)$$
$$= 962 \quad \text{m}^3/\text{day}$$
$$= 962000 \quad \text{L/day} \quad H$$

Number of Units			

$$U = H / (A \times B \times E)$$
$$= 356 \quad \text{units}$$

Appendix I: Treated Water Storage

Treated Water Storage

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure		**Designed By:**	MC
Project No:	19055		**Date:**	2020-06-03

Existing Conditions

Design Criteria				
Population:	1,380		A	
Suggested Fire Flow (MOE):	79	L/s	B	
Duration:	2.0	Hours	C	
Max. Day Demand (Average 2011-2019):	1,003	m³/day	D	

Calculations				
Fire Storage				
	V_{FS}	=	(B x C) x 3.6	
		=	569	m³
Equalization Storage				
	V_{EQ}	=	D x 0.25	
		=	251	m³
Emergency Storage				
	V_{EM}	=	$(V_{FS} + V_{EQ})$ x 0.25	
		=	205	m³
Total Treated Water Storage Requirement				
	V_T	=	$V_{FS} + V_{EQ} + V_{EM}$	
		=	**1024**	m³

Treated Water Storage

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure	**Designed By:**	MC
Project No:	19055	**Date:**	2020-06-03

Existing + Phase 1

Design Criteria			
Population:	3,597		A
Suggested Fire Flow (MOE):	119	L/s	B
Duration:	2.0	Hours	C
Max. Day Demand[1]:	2,999	m³/day	D
Calculations			

Fire Storage

$$V_{FS} = (B \times C) \times 3.6$$
$$= 857 \quad m^3$$

Equalization Storage

$$V_{EQ} = D \times 0.25$$
$$= 750 \quad m^3$$

Emergency Storage

$$V_{EM} = (V_{FS} + V_{EQ}) \times 0.25$$
$$= 402 \quad m^3$$

Total Treated Water Storage Requirement

$$V_T = V_{FS} + V_{EQ} + V_{EM}$$
$$= \mathbf{2008} \quad m^3$$

1. Maximum Day Demand is the average maximum day for existing conditions from actual flows (2011-2019) plus the theoretical maximum day calculated for Phase 1 development areas.

Treated Water Storage

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure	**Designed By:**	MC
Project No:	19055	**Date:**	2020-06-03

Existing + Phase 1 + Phase 2

Design Criteria			
Population:	4,478		A
Suggested Fire Flow (MOE):	134	L/s	B
Duration:	2.0	Hours	C
Max. Day Demand[1]:	3,792	m³/day	D
Calculations			
Fire Storage			
V_{FS} =	(B x C) x 3.6		
=	966	m³	
Equalization Storage			
V_{EQ} =	D x 0.25		
=	948	m³	
Emergency Storage			
V_{EM} =	$(V_{FS} + V_{EQ})$ x 0.25		
=	478	m³	
Total Treated Water Storage Requirement			
V_T =	$V_{FS} + V_{EQ} + V_{EM}$		
=	**2392**	m³	

1. Maximum Day Demand is the average maximum day for existing conditions from actual flows (2011-2019) plus the theoretical maximum day calculated for Phase 1+Phase 2 development areas.

Treated Water Storage

ENGAGE ENGINEERING

Project Name:	Norwood Infrastructure	**Designed By:**	MC
Project No:	19055	**Date:**	2020-06-03

Existing + Phase 1 + Phase 2 + Phase 3

Design Criteria			
Population:	7,412		A
Suggested Fire Flow (MOE):	170	L/s	B
Duration:	3.0	Hours	C
Max. Day Demand[1]:	6,432	m³/day	D
Calculations			

Fire Storage

$$V_{FS} = (B \times C) \times 3.6$$
$$= 1836 \quad m^3$$

Equalization Storage

$$V_{EQ} = D \times 0.25$$
$$= 1608 \quad m^3$$

Emergency Storage

$$V_{EM} = (V_{FS} + V_{EQ}) \times 0.25$$
$$= 861 \quad m^3$$

Total Treated Water Storage Requirement

$$V_T = V_{FS} + V_{EQ} + V_{EM}$$
$$= \mathbf{4305} \quad m^3$$

1. Maximum Day Demand is the average maximum day for existing conditions from actual flows (2011-2019) plus the theoretical maximum day calculated for Phase 1+Phase 2+Phase 3 development areas.

Appendix J: Water Pressure Calculations

Hazen-Williams
Desired Pressure

ENGAGE ENGINEERING

Project Name: Norwood Infrastructure Assessment
Project No: 19055

Designed By: MC
Date: 2019-12-17

H24 - 2362 County Road 45

Design Criteria			
GPM to LPM Conversion:	3.785	L/min = 1gpm	A
Field Flow Test:	1233	gpm	B
Static Pressure at Residual Hydrant:	60	psi	C
Minimum Operating Pressure:	40	psi	D
Residual Pressure during Flow Test:	56	psi	E
Calculations			
Residual Pressure			
H_R = C - D			
= 20		psi	
Flow Pressure			
H_F = C - E			
= 4		psi	
Flow at 40psi			
Q_R = B x $(H_R/H_F)^{0.54}$			
= 2940		gpm	
= **11129**		**L/min**	

Hazen-Williams Desired Pressure

Project Name: Norwood Infrastructure Assessment **Designed By:** MC
Project No: 19055 **Date:** 2019-12-17

H67 - 4420 Highway 7

Design Criteria			
GPM to LPM Conversion:	3.785	L/min = 1gpm	A
Field Flow Test:	702	gpm	B
Static Pressure at Residual Hydrant:	48	psi	C
Minimum Operating Pressure:	40	psi	D
Residual Pressure during Flow Test:	16	psi	E
Calculations			
Residual Pressure			
	H_R =	C - D	
	=	8	psi
Flow Pressure			
	H_F =	C - E	
	=	32	psi
Flow at 40psi			
	Q_R =	B x $(H_R/H_F)^{0.54}$	
	=	332	gpm
	=	**1257**	**L/min**