

Phase 2 Report
North Grenville Water and Wastewater Servicing Master Plan Update

Appendix A

Existing and Future Population, Employment and
Land Use Implications and Analysis (J.L. Richards
& Associates Limited, March 13, 2025)

Existing and Future Population, Employment, and Land Use Implications and Analysis

Municipality of North Grenville Servicing Master Plan Update



Existing and Future Population, Employment, and Land Use Implications and Analysis

Servicing Master Plan Update

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**Existing and Future Population, Employment, and Land Use
Implications and Analysis
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Existing and Future Population, Employment, and Land Use Implications and Analysis

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1.0 Introduction

The Municipality of North Grenville (the Municipality) is a small- to mid-sized community comprised of a mix of rural and urban development. Located adjacent to the southern border of the City of Ottawa, the Municipality has experienced tremendous growth over recent years. In fact, it is one of the fastest growing communities in eastern Ontario. Most of the growth is expected to be within the northwest quadrant of the urban area. Due to this elevated growth rate the Municipality is experiencing, the Municipality retained J.L. Richards & Associates Limited (JLR) to update the North Grenville Water and Wastewater Servicing Master Plan, which was originally produced in 2015.

As part of this Master Plan update, JLR is identifying population projections for the zero to five (5) year, five (5) to ten (10) year, ten (10) to twenty (20) year and twenty plus year (20 +) buildout timeframes for the Servicing Master Plan. It should be noted that the Municipality recently had a Long-term Population, Housing and Employment Study (December 2023) completed by KPMG to help inform their upcoming Official Plan Review. Our analysis used the findings from the KPMG report to help calculate the estimated populations to inform the Servicing Master Plan. It is not meant to replace the findings of the KPMG report for Official Plan purposes.

2.0 Settlement Strategy and Census Data

The Municipality has experienced significant growth between 2011 to 2021, at a rate of just over 9% for every five-year period. During this period, the Municipality added an average of 135 new dwelling units each year. The Municipality recently conducted a Long-term Population, Housing and Employment Study (December 2023) which identified the long-term population, housing, and employment projections for the planning horizon of 2046.

Based on the Statistics Canada 2021 Census of Population, the Municipality of North Grenville's population was 17,964 people, while Kemptville [population centre] had a population of 4051 people. The Long-term Population, Housing and Employment Study (December 2023) identified the population of Kemptville as approximately 6,000 people in the urban service area. The discrepancy between the two figures is likely because the geographic area for Kemptville [population centre] does not account for the entirety of the urban serviced area of Kemptville.

According to the Long-term Population, Housing and Employment Study (December 2023), the average household size in the Municipality of North Grenville is 2.5 persons per dwelling unit. However, according to Statistics Canada, the average household size in Kemptville [population centre] is 2.2 persons per dwelling unit. As previously noted, the Kemptville [population centre] does not factor all the lands within the Kemptville urban serviced area, which is likely the source of this discrepancy. Therefore, it is recommended that a conservative population density (per person per dwelling unit) is used to help inform the population projection. It is recommended that the average between the two different North Grenville and Kemptville [population centre] densities (per person per dwelling unit) be used, which is 2.35 persons per dwelling unit.

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3.0 Residential Infill and Intensification

The Municipality of North Grenville Official Plan (2018) has targeted 20% of growth in areas that are specified in North Grenville’s infill and intensification policies. According to the Long-term Population, Housing and Employment Study (December 2023), in the census-designated place of Kemptville [population centre], the net residential development across all housing types only comprised 18% of the total new housing development in the Municipality. This is slightly below the stated goal of 20%.

According to the study, all development within the Kemptville [population centre] census area between 2016 and 2021 was in the form of higher density housing. It is important to note that most of the new development within the Kemptville urban serviced area is outside of the Kemptville [population centre] census area. Therefore, the information in Table 1 should be used to determine infill and intensification only.

Table 1: Development in Kemptville and the Municipality (2016 to 2021) by Housing Type

Housing Type	Kemptville			Municipality of North Grenville			Kemptville Share (%)
	2016	2021	Five-Year Increase	2016	2021	Five-Year Increase	
Single Detached	1020	1020	0	5355	5790	435	0%
Semi-detached + other detached	185	215	30	275	330	55	55%
Duplex + Row House	270	310	40	395	460	65	62%
Apartment	220	255	35	380	425	45	78%
Total	1695	1800	105	6405	7005	600	18%

The Long-term Population, Housing and Employment Study (December 2023) provided three growth scenarios (low-, medium-, high-growth). They assume 30%, 50%, and 70%, of projected growth, respectively, for the County of Leeds and Grenville. The study noted that Scenario 2 (Medium Growth) is the most likely population growth scenario. It is used to create housing demand projections.

Table 2: Medium Growth Scenario (Municipality, 2023)

Year	Population	Five-Year Growth
2021 ⁽¹⁾	17,964	9.2%
2026	20,845	16%
2031	23,088	10.8%
2036	25,483	10.4%
2041	27,980	9.8%
2046	30,602	9.4%

Table Notes:

(1) 2021 Actual figure from Statistics Canada

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4.0 Projected Demand for New Housing

The Municipality’s Official Plan set the following targets for new development:

- Low Density (Approximately 18 units/ha): 68%
- Medium Density (approximately 30 units/ha): 21%
- High Density (approximately 45 units/ha): 11%

These are targets to be met or exceeded, not requirements under the Official Plan.

The Long-term Population, Housing and Employment Study (December 2023) did not use these targets but relied on observed historical trends since 2016. Based on these housing trends, the study predicted there will be a significant shift in the projected housing types. The projected housing shifts are in Table 3.

Table 3: Projected Housing Shifts (2021 to 2046) (Municipality, 2023)

End of Five-Year Period	Total New Dwellings	Single Detached Dwellings	Mid-Density Row house	Low-Rise Apartment
2021 ⁽¹⁾	605	435	120	45
2026	758	506	189	63
2031	848	513	256	79
2036	862	458	314	90
2041	874	388	384	102
2046	958	324	509	125
Total	4,905	2,624	1,772	504

Table Notes:

- (1) 2021 Actual figure from Statistics Canada.

The distribution of each housing typology is summarized as percentages in Table 4.

Table 4: Projected Housing Typology (2021 to 2046) by Percentage (Municipality, 2023)

End of Five-Year Period	Single-detached House (%)	Mid-Density Row House (%)	Low-Rise Apartment (%)
2021 ⁽¹⁾	72%	20%	7%
2026	67%	25%	8%
2031	60%	30%	9%
2036	53%	36%	10%
2041	44%	44%	12%
2046	34%	53%	13%

Table Notes:

- (1) 2021 Actual figure from Statistics Canada.

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5.0 Housing Land Demand

Based on the growth projections in the Long-term Population, Housing and Employment Study (December 2023), a total of 4,905 dwelling units will be required to meet the Municipality’s residential needs. While the Official Plan directs most of the development towards the Kemptville urban serviced areas or the hamlets, it does not specify a target based on settlement boundaries.

The study projected the following assumptions of average gross dwelling units per hectare to be used for new developments.

- Single Detached House 18 units/ha
- Mid-Density Row House 30 units/ha
- Low-Rise Apartments 45 units/ha

At the time the study was written (2023), development had been approved through *Planning Act* applications for approximately 1790 new dwelling units. Of these, 244 were expected to be built by 2024. The projected number of dwelling units required for this five-year period (ending in 2026) was 758. The study provided a three-year projection, identifying a total of 454 new dwelling units required.

If 244 units were expected to be built by 2024, then an additional 210 dwelling units are remaining to be built between 2024 and 2026.

The study provided the following land use projections:

Table 5: Land Use Projections (2026 to 2046) (Municipality of North Grenville, 2023)

End of Five-Year Period	Area (ha)				Cumulative Land
	Single Detached	Mid-Density	Apartment	Total Land	
2026	28.1	6.3	1.4	35.8	35.8
2031	28.5	8.5	1.8	38.8	74.6
2036	25.4	10.5	2.0	37.9	112.5
2041	21.6	12.8	2.3	36.6	149.1
2046	18.0	17.0	2.8	37.7	186.9
Total	121.6	55.1	10.2	186.0	186.9

The Municipality of North Grenville provided building permit information for the years spanning 2016 through 2021, including the housing typology. The following tables provide a breakdown of these numbers.

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Table 6: Historical Building Permits for Single Detached Dwellings (2016 to 2021)

Year	Urban	Rural	Total % Urban
2016	84	33	72
2017	76	51	60
2018	110	43	72
2019	36	38	49
2020	96	41	70
2021	74	63	54
Total	476	269	64 (average)

Based on the building permit information received from the Municipality, the Municipality averaged 79 building permits for Single Detached Dwellings per year, from 2016 through 2021.

Table 7: Historical Building Permits for Mid-Density Row Houses (2016 to 2021)

Year	Urban	Rural	Total % Urban
2016	23	0	100
2017	37	0	100
2018	13	0	100
2019	3	0	100
2020	20	0	100
2021	42	0	100
Total	138	0	100

Based on the building permit information received from the Municipality, the Municipality averaged 23 building permits for Mid-Density Row Housing per year, from 2016 through 2021.

Table 8: Historical Building Permits for Apartments (2016 to 2021)

Year	Urban	Rural	Total % Urban
2016	7	0	100
2017	1	2	33
2018	22	0	100
2019	0	0	0
2020	0	0	0
2021	18	4	82
Total	48	6	89 (average)

Based on the building permit information received from the Municipality, the Municipality averaged eight building permits for apartment units per year, from 2016 through 2021.

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6.0 Urban Serviced Greenfield Development & Re-development Outside the Kemptville [population centre] Census Area

The Long-term Population, Housing and Employment Study (December 2023) provided the number of dwelling units by housing type which was added to the Kemptville [population centre] census area for the years of 2016 through 2021. This information was used in the report to determine how the Municipality was meeting its infill/intensification targets of the Official Plan. However, it did not provide information on the greenfield development, or redevelopment occurring outside of the Kemptville [population centre] census area, which includes a significant portion of the urban service boundary and is where most of the urban serviced growth has occurred.

To better understand how much development has occurred, by housing type, through Greenfield development and redevelopment within the urban serviced areas outside the Kemptville [population centre] census area, the total number of dwelling units by housing type for the Kemptville [population centre] census area were subtracted from the overall urban serviced building permit data provided by the Municipality.

6.1 Single Detached Dwellings

There were no single detached dwellings identified in the Kemptville [population centre] census area. Therefore, all the 476 single detached dwelling building permits for the urban serviced area occurred outside the Kemptville [population centre] census area. This averages to approximately 79 single detached dwellings a year, between 2016 through 2021.

6.2 Mid-Density Row Housing

According to the Long-term Population, Housing and Employment Study (December 2023), the Kemptville [population centre] census area had a total of 70 new mid-density row housing. The entire serviced area had a total of 138 building permits issued for mid-density row housing between 2016 and 2021.

$$138 - 70 = 68 \text{ Total Mid-Density Row Housing}$$

A total of 68 mid-density row housing dwelling units were added to the urban serviced area outside the Kemptville [population centre] census area from 2016 through 2021. These units can be attributed to greenfield development and redevelopment of existing sites. This averages to approximately 11 mid-density row housing dwelling units per year for that five-year span.

6.3 Apartment Dwelling Units

According to the Long-term Population, Housing and Employment Study (December 2023), the Kemptville [population centre] had a total of 35 new apartment dwelling units, while the entire serviced area had a total of 48 building permits issued for mid-density row housing.

$$48 - 35 = 13 \text{ Total Apartments}$$

A total of 13 apartment dwelling units were added to the urban serviced area outside the Kemptville [population centre] census area between 2016 through 2021. These units can be attributed to greenfield

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development and redevelopment of existing sites. This averages to approximately two apartment dwelling units per year for that five-year span.

Using the information above, a percentage of housing typology can be derived for both the Kemptville [population centre] census area and the remaining urban serviced area, assumed to be greenfield development and redevelopment of existing sites.

Table 9: Housing Typology Distribution by Service Area

Housing Typology	Kemptville [population centre] five-year change	Other Urban Serviced Areas five-year change	Total of Housing Typology in Other Urban Serviced Areas (%)
Single Detached Dwelling Units	0	476	100
Mid-Density Row Housing	70	68	49
Apartments	35	13	27

7.0 Population Analysis

To provide a more accurate understanding of the projected population, particularly for infill/intensification (Kemptville [population centre] census area) and greenfield/redevelopment (outside the Kemptville [population centre] census area), the existing numbers (Municipality of North Grenville) must be broken down to determine how much housing typology can be expected within the urban serviced area.

This can be achieved through multiplying the total housing typology numbers projected for the five-year intervals provided in the Long-term Population, Housing and Employment Study (December 2023), by the observed urban housing typology percentages from 2016 to 2021 for the urban serviced area. This results in a projected total number of units required in the urban serviced area, based on observed percentages.

7.1 Single Detached Dwellings

Table 10: Single Detached Dwelling Required in the Urban Serviced Area (2026 to 2046)

Five-Year Period Ending	Total Dwelling Units	Percent of Single Detached Dwellings in the Urban Serviced Area (2016 to 2021)	Total Units Required in the Urban Serviced Area
2026	506	64%	324
2031	513		328
2036	458		293
2041	388		248
2046	324		207

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7.2 Mid-Density Row Housing

For the Mid-Density Row Housing, the observed percentage of this housing typology within the Urban Serviced area is 100%. Therefore, the number of dwelling units for each five-year interval remains the same as those projected in the Long-term Population, Housing and Employment Study (December 2023). These numbers are:

Table 11: Mid-Density Row Housing Required in the Urban Serviced Area (2026 to 2046)

Five-Year Period Ending	Total Dwelling Units Required in the Urban Serviced Area
2026	189
2031	256
2036	314
2041	384
2046	509

7.3 Apartment Dwelling

Table 12: Apartment Dwelling Units Required in the Urban Serviced Area (2026 to 2046)

Five-Year Period Ending	Total Dwelling Units	Percent of Apartment Units in the Urban Serviced Area (2016 to 2021)	Total Units Required in the Urban Serviced Area
2026	63	89%	56
2031	79		70
2036	90		80
2041	102		91
2046	125		111

7.4 Housing Typology Distribution

After determining the dwelling units required for each housing typology in the urban serviced area for each five-year interval, the distribution of each housing typology within Kemptville [population centre] census area and the other urban serviced areas can be determined. This can be achieved through multiplying the total number of each housing typology total units required (urban serviced area) by the observed percentages in housing typologies from 2016 to 2021 in Table 9.

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Table 13: Number of Single Detached Dwelling Units Required (2026 to 2046)

Five-year Ending	Total Dwellings Units Required (Other Urban Serviced Areas)
2026	324
2031	328
2036	293
2041	248
2046	207

As seen in Table 9 for single detached dwellings, all units (100%) within the urban serviced area were entirely outside the Kemptville [population centre] census area.

Table 14: Number and Distribution of Mid-Density Row Housing Units Required (2026 to 2046)

Five-year Ending	Total Dwelling Units Required	Housing Typology (%)		Total Dwelling Units Required	
		in Kemptville [population centre]	in Other Urban Serviced Areas	in Kemptville [population centre]	in Other Urban Serviced Areas
2026	189	51	49	96	93
2031	256	51	49	131	125
2036	314	51	49	160	154
2041	384	51	49	196	188
2046	509	51	49	260	249

Table 15: Number and Distribution of Low Rise Apartment Units Required (2026 to 2046)

Five-year Ending	Total Dwelling Units Required	Housing Typology (%)		Total Dwelling Units Required	
		in Kemptville [population centre]	in Other Urban Serviced Areas	in Kemptville [population centre]	in Other Urban Serviced Areas
2026	56	73	27	41	15
2031	70	73	27	51	19
2036	80	73	27	58	22
2041	91	73	27	66	25
2046	111	73	27	81	30

Using the numbers derived from the total number of dwelling units required for the Kemptville [population centre] census area and for other urban serviced areas, a total hectare for each area can be calculated using the projected assumptions of average gross dwelling unit per hectare to be used for new

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developments cited in the Long-term Population, Housing and Employment Study (December 2023). This can be done by dividing the total number of dwelling units by the average gross dwelling unit per hectare for each housing typology.

For the single detached dwellings, 18 units/ha was used.

Table 16: Number of Single Detached Dwelling Units and Land Required by Serviced Area Type (2026 to 2046)

Five-year Ending	Total Dwelling Units Required		Total Hectares Required		
	In Kemptville [population centre]	in Other Urban Serviced Areas	In Kemptville [population centre]	In Other Urban Serviced Areas	for entire Urban Serviced Area
2026	0	324	0	18	18
2031	0	328	0	18.2	18.2
2036	0	293	0	16.3	16.3
2041	0	248	0	13.8	13.8
2046	0	207	0	11.5	11.5
Total	0	1400	0	77.8	77.8

For Mid-Density Row Housing, 30 units/ha was used.

Table 17: Number of Mid-Density Row Housing Units and Land Required by Serviced Area Type (2026 to 2046)

Five-year Ending	Total Dwelling Units Required		Total Hectares Required		
	In Kemptville [population centre]	in Other Urban Serviced Areas	In Kemptville [population centre]	In Other Urban Serviced Areas	for entire Urban Serviced Area
2026	96	93	3.2	3.1	6.3
2031	131	125	4.4	4.2	8.6
2036	160	154	5.3	5.1	10.4
2041	196	188	6.5	6.3	12.8
2046	260	249	8.7	8.3	17
Total	843	809	28.1	27	55.1

For Low Rise Apartments, 45 units/ha was used.

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Table 18: Number of Low Rise Apartment Units and Land Required by Serviced Area Type (2026 to 2046)

Five-year Ending	Total Dwelling Units Required		Total Hectares Required		
	In Kemptville [population centre]	in Other Urban Serviced Areas	In Kemptville [population centre]	In Other Urban Serviced Areas	for entire Urban Serviced Area
2026	41	15	0.9	0.3	1.2
2031	51	19	1.1	0.4	1.5
2036	58	22	1.3	0.5	1.8
2041	66	25	1.5	0.6	2.1
2046	81	30	1.8	0.7	2.5
Total	298	111	6.6	2.5	9.1

8.0 Projected Population

8.1 Residential Population Projections

For land holdings where the mix of housing typologies proposed or approved was known, the Municipality has requested that we use the per person per units identified in the Municipality of North Grenville Engineering Standards for Design, Approval, and Construction, Section D, D2.05 for Domestic Demand which is as follows:

- Single Detached Dwellings = 3.4 person/unit
- Semi-Detached Dwellings = 2.7 person/unit
- Townhouse = 2.7 person/unit
- Apartments = 2 person/unit

JLR has also applied these per person per units to each typology for the projected population using the KPMG report information to ensure the same per person per unit counts were used for a proper comparison. For all other land holding areas where the housing typologies are not known, to obtain a projected population of the urban serviced area, the total number of dwelling units required is multiplied by the projected person per dwelling unit (2.35) calculated in Section 2.

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Table 19: Projected Population for Single Detached Dwelling Units (2026 to 2046)

Five-year Ending	Total Dwellings Required			Projected Population		
	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Serviced Areas	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Urban Serviced Areas
2026	324	0	324	1102	0	1102
2031	328	0	328	1115	0	1115
2036	293	0	293	996	0	996
2041	248	0	248	843	0	843
2046	207	0	207	704	0	704
Total	1400	0	1400	4760	0	4760

Table 20: Projected Population for Mid-Density Row Housing (2026 to 2046)

Five-year Ending	Total Dwellings Required			Projected Population		
	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Serviced Areas	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Urban Serviced Areas
2026	189	96	93	510	259	251
2031	256	131	125	691	354	338
2036	314	160	154	848	432	416
2041	384	196	188	1037	529	508
2046	509	260	249	1374	702	672
Total	1652	843	809	4460	2276	2184

Table 21: Projected Population for Low Rise Apartments (2026 to 2046)

Five-year Ending	Total Dwellings Required			Projected Population		
	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Serviced Areas	Kemptonville [population centre] and Other Urban Serviced Areas	Kemptonville [population centre]	Other Urban Serviced Areas
2026	57	42	15	114	84	30

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Five-year Ending	Total Dwellings Required			Projected Population		
	Kemptville [population centre] and Other Urban Serviced Areas	Kemptville [population centre]	Other Serviced Areas	Kemptville [population centre] and Other Urban Serviced Areas	Kemptville [population centre]	Other Urban Serviced Areas
2031	70	51	19	140	102	38
2036	80	58	22	160	116	44
2041	91	66	25	182	132	50
2046	111	81	30	222	162	60
Total	409	298	111	818	596	262

The Municipality has provided information on the number of existing dwelling units approved or planned (including the housing typologies) through *Planning Act* applications for all properties in the Town of Kemptville urban serviced area. Based on this information, the number of approved or planned dwelling units can be multiplied by the projected per person per dwelling unit identified in the Municipality of North Grenville Engineering Standards for Design, Approval, and Construction to obtain a projected population for each land holding.

For the purposes of this analysis, all commercial properties which the Municipality had identified as potential conversion to residential has been assigned a total population projection based on residential demands as the residential population projection would yield a higher population projection. All land holding areas (ha) were calculated using the geometry area of the parcel fabric. All land holdings which contained the wetland identified in the Northwest Quadrant by Niblett Environmental, and the floodplain as identified by RVCA has been subtracted from the total land holding area used in any calculations.

8.2 Population Projection (Year Intervals)

Table 22: Population Projection (0 - 5 Years)

Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
1*	154	40		632
3*	100	213	120	1155
7*			48	96
13			63	126
14			48	96

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Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
17			50	100
18			8	16
19			69	138
20			59	118
22		26	26	122
23*		30		81
27			79	158
Total	254	309	570	2838
Total Kempville [population centre]	0	26	402	874
Total Other Urban Serviced Areas	254	283	168	1964

Table Notes:

* Denotes properties outside Kempville [population centre] designated census area

The properties identified as being within the 0-5 year interval can be found in Figure 1.

Table 23: Population Projection (5 - 10 Years)

Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
2*		32	398	882
7*	0	0	168	336
13		28		76

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Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
14			60	120
19			40	80
20			109	218
23*		20		54
27			43	86
47*		92		248
59	2	33	8	112
Total	2	205	826	2212
Total Kempville [population centre]	2	61	260	692
Total Other Urban Serviced Areas	0	144	566	1521

Table Notes:

* Denotes properties outside Kempville [population centre] designated census area

The properties identified as being within the 5-10 year interval can be found in Figure 2.

Table 24: Population Projection (10 - 20 Years)

Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
2*	110	415		1495
10*	306	448	0	2250
15			36	72

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Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
47*	0	89	150	540
Total	416	952	186	4357
Total Kemptville [population centre]	0	0	36	72
Total Other Urban Serviced Areas	416	952	150	4285

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

The properties identified as being within the 10-20 year interval can be found in Figure 3.

Table 25 Population Projection (20 Plus Years)

Map ID	Single Detached	Semi Detached/Townhouse	Apartments	Total Population Projection
10*	152	139		892
Total	152	139		892
Total Kemptville [population centre]	0	0	0	0
Total Other Urban Serviced Areas	152	139	0	175

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

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For the residential land holdings where there were no approved or proposed dwelling units identified, the projected population must be determined. Through discussions with the Municipality, it was determined to use the average number of the following assumed average gross dwelling unit per hectare numbers from the of the Long-term Population, Housing and Employment Study (December 2023). Those numbers were as follows:

- Single Detached House 18 units/ha
- Mid-Density Row House 30 units/ha
- Low-Rise Apartments 45 units/ha

$$18 \text{ units/ha} + 30 \text{ units/ha} + 45 \text{ units/ha} / 3 = 31 \text{ units/ha}$$

Through discussions with the Municipality, it was determined that adding a 10% to the average unit/hectare was desirable in order to account for some potential Additional Residential Units. This results in density of 34 units/ha. This number can be used to calculate the projected population for each residential land holding which does not have approved or proposed dwelling units. This can be done by multiplying the unit per hectare by the size of the land holding to obtain the total dwelling units per property. The total dwelling units per property is then multiplied by 2.35 persons per dwelling unit to obtain the projected population.

There were no vacant residential land holdings for the 0-5 year interval where the housing typology was not known. Therefore, no calculations for this interval were required.

Table 26: Population Projection 5 - 10 Years

Map ID	Land Area (hectare)	Total Potential Dwelling Units (Land Size x 34 units/ha)	Projected Population (Dwelling Units x 2.35 person per unit)
9*	2.6	87	205
44	1.2	42	99
Total	3.8	129	304
Total Kemptville [population centre]	1.2	42	99
Total Other Urban Serviced Areas	2.6	87	205

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

Existing and Future Population, Employment, and Land Use Implications and Analysis

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Table 27: Population Projection 10 - 20 Years

Map ID	Land Area (ha)	Total Dwelling Units (Land size x 34 units/ha)	Projected Population (Dwelling Units x 2.35 persons per unit)
4*	8.0	273	641
6*	11.6	395	928
8*	9.3	318	746
26*	7.4	253	594
30*	17.0	579	1361
47*	2.7	91	214
52*	6.0	358 ⁽¹⁾	841
56	1.1	36	85
58	2.4	81	191
Total	65.6	2384	5602
Total Kemptville [population centre]	3.5	118	276
Total Other Urban Serviced Areas	62.1	2266	5326

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

(1) Calculated using 60 units/ha as provided by the Municipality.

Table 28: Population Projection 20 Plus Years

Map ID	Land Area (ha)	Total Dwelling Units (Land size x 34 units/ha)	Projected Population (Dwelling Units x 2.35 persons per unit)
11	2.5	84	197
12	10.5	356	837
24*	1.8	62	145
34*	2.9	98	230
36*	13.8	468	1099
Total	31.4	1067	2508

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Map ID	Land Area (ha)	Total Dwelling Units (Land size x 34 units/ha)	Projected Population (Dwelling Units x 2.35 persons per unit)
Total Kemptville [population centre]	12.9	440	1034
Total Other Urban Serviced Areas	18.5	627	1474

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

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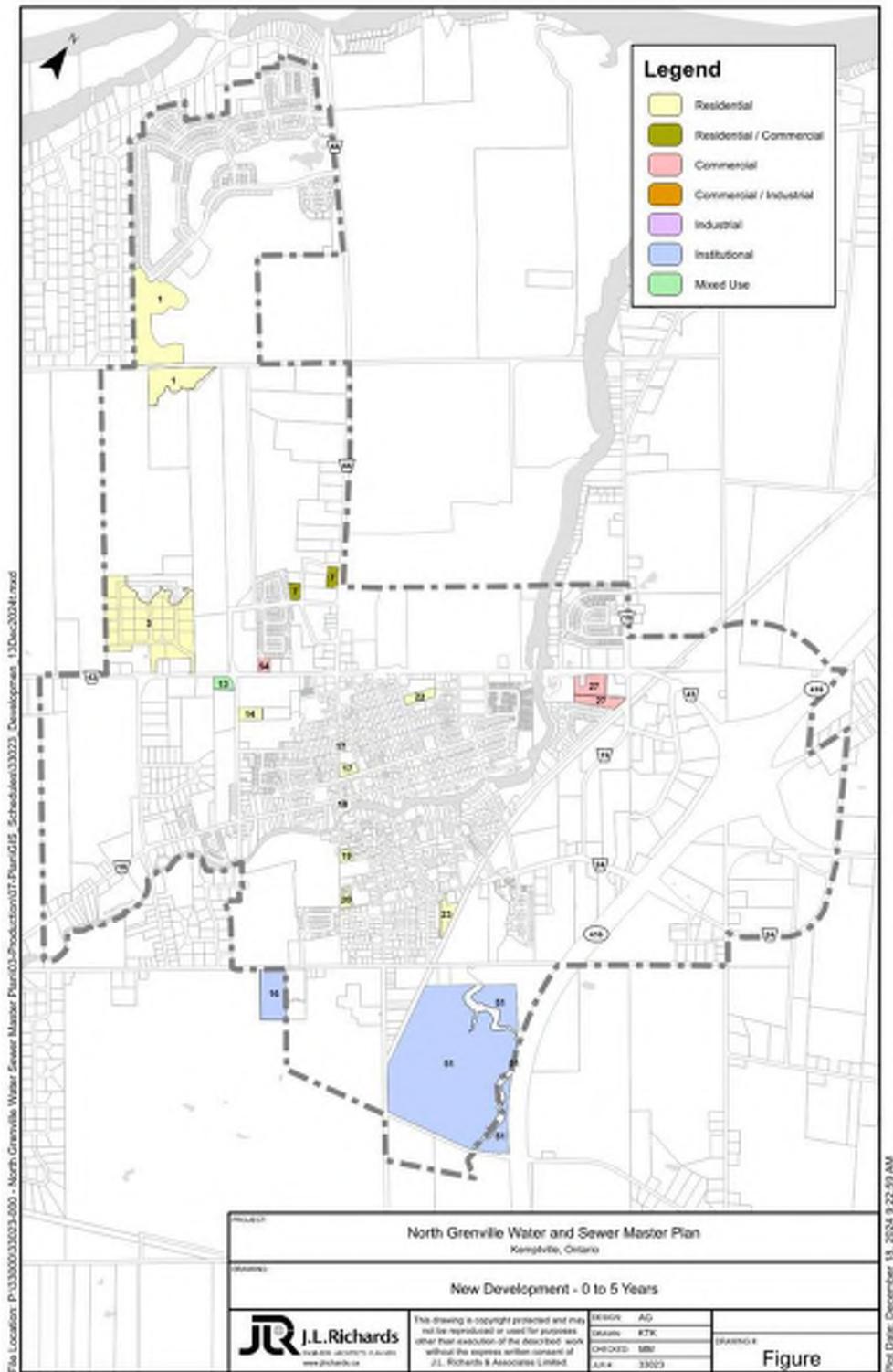


Figure 2: 0-5 Year Land Holdings

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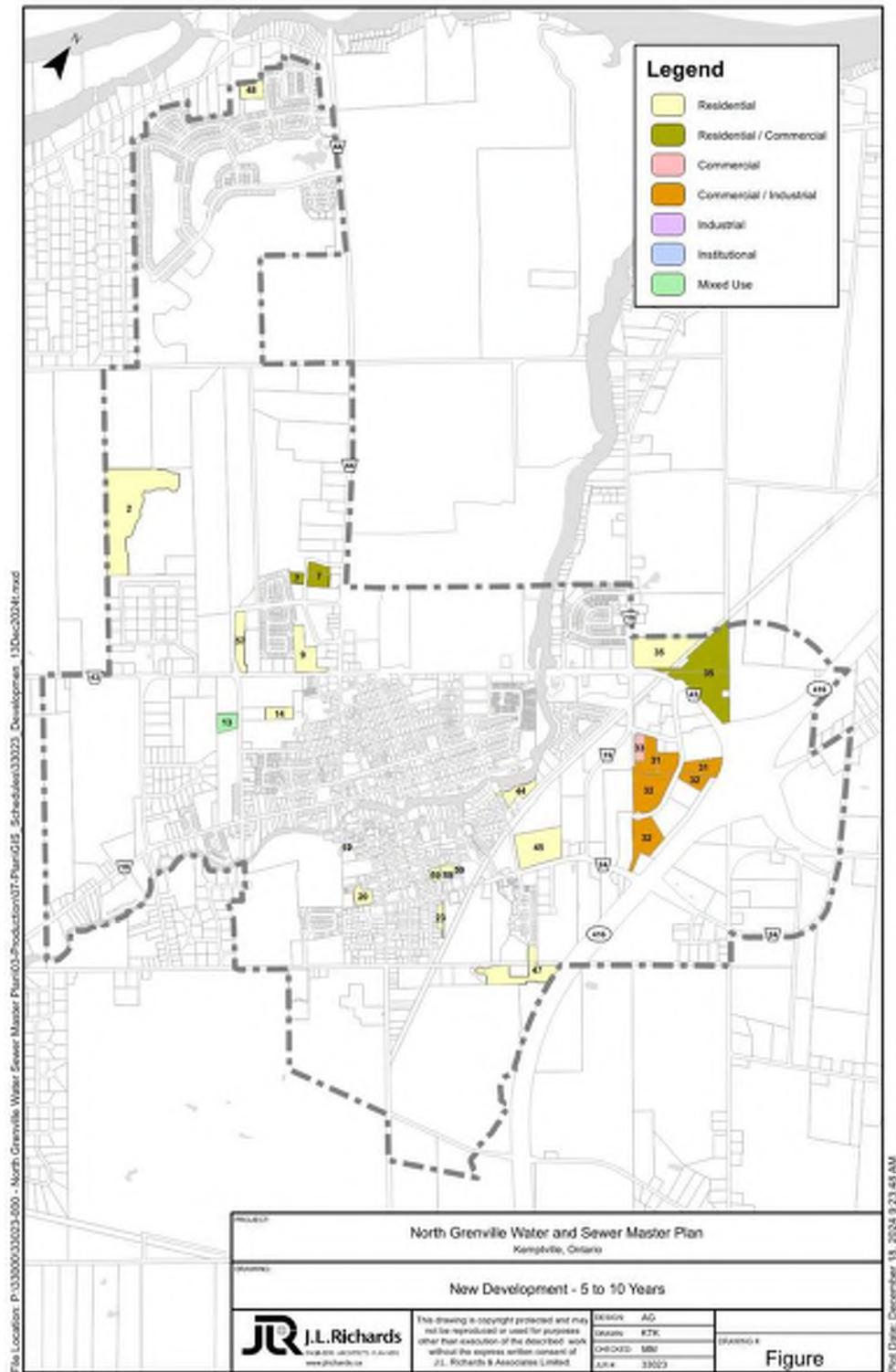


Figure 3: 5-10 Year Land Holdings

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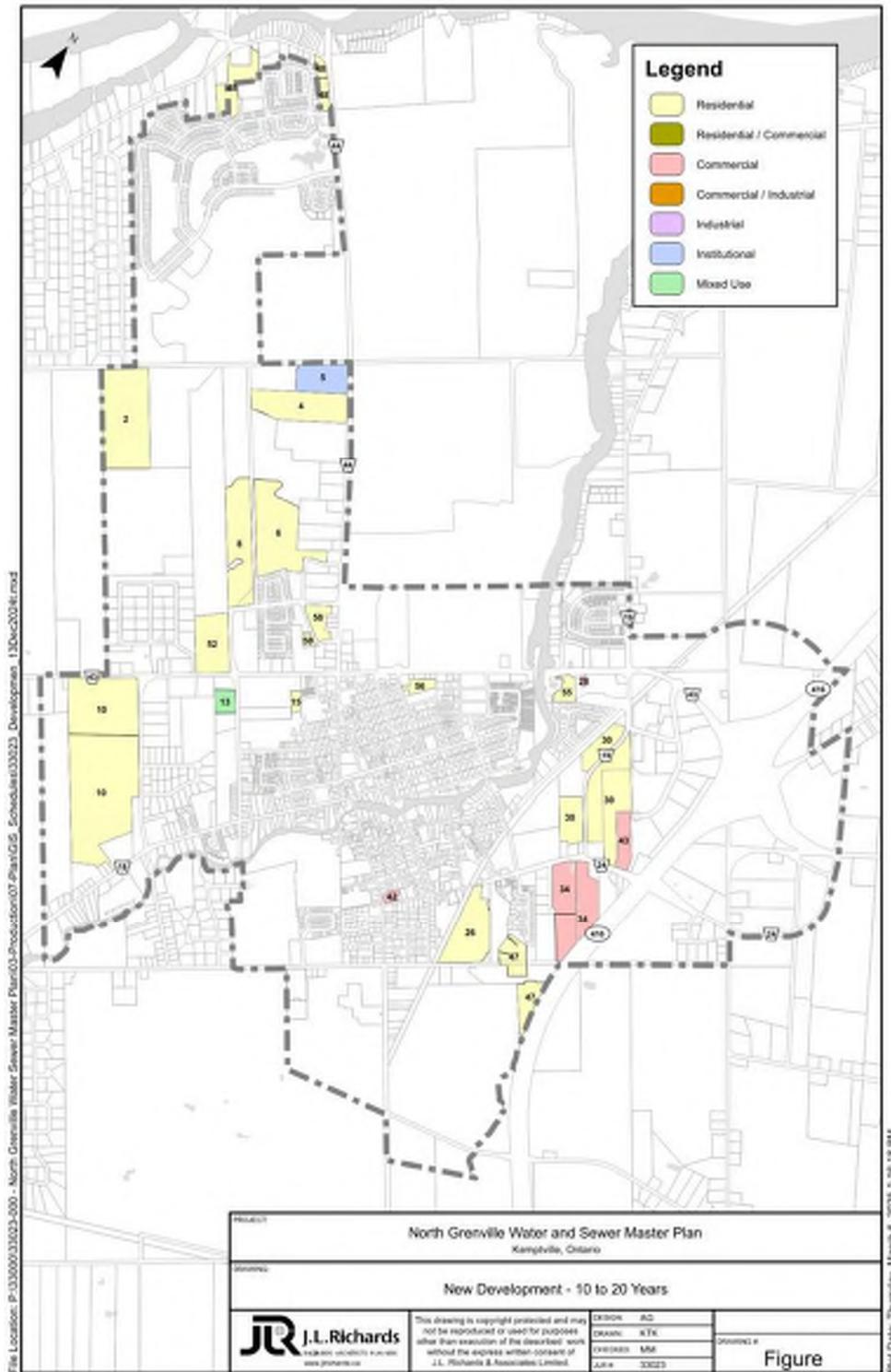


Figure 4: 10-20 Year Land Holdings

Existing and Future Population, Employment, and Land Use Implications and Analysis

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8.3 Candidate Expansion Areas

Based on information in the Long-term Population, Housing and Employment Study (December 2023) by KPMG, two main expansion candidate areas to the urban boundary were identified. These have been identified by the Municipality as the Western Expansion Area and the Northeast Expansion Lands. The KPMG report had provided an estimate on the capacity of each expansion area based on high density. The following projections were provided:

Western Expansion Area = 1823 potential residential units
Northeast Expansion Area = 1256 potential residential units

A third expansion area was identified by the Municipality as the Northern Expansion Lands. No projected unit count for this area was provided.

Western Expansion Area (MAP ID 49)

Correspondence from the Municipality directly from the planning consultant working on the Western Expansion Area candidate site has indicated that the rough estimate is approximately 1,941 units. While it is understood that this number could change, this number will be used for this analysis. To calculate the total projected population of the Western Expansion Area, the total units proposed is multiplied by the 2.35 persons per units.

$1,941 \times 2.35 = 4,561$ projected population

Northeast Expansion Area (MAP ID 50)

The Northeast Expansion Area boundaries identified by the Municipality differs slightly from the Northeast Expansion Area boundaries by the KPMG report. The area identified by the Municipality provided some additional lands not contemplated by the KPMG report. Therefore, these additional lands need to be added to the total projected units provided by KPMG for the Northeast Expansion Area. Using the high density rate of 45 units per hectare provided by KPMG, the total projected units for the additional lands can be calculated. The total potential residential lands for the additional lands can then be added to the total of potential residential units provided by the KPMG report. The Municipality has identified this expansion area for the 20 plus year interval.

$13.7 \text{ hectares} \times 45 \text{ units/ha} = 617$ potential residential units for the additional lands
 $617 \text{ potential residential units} + 1256 \text{ potential residential units} = 1873$ potential residential units

The Northeast Expansion Area projected population can be calculated using the projected number of dwelling units multiplied by 2.35 person per unit.

$1873 \times 2.35 = 4,402$ projected population (based on high density)

Northern Expansion Area (MAP ID 48)

The Municipality had also provided a third candidate expansion area identified as the Northern Expansion Area. The first phases are predicted to occur within the 5-10 year interval, while the second phases are

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predicted to occur during the 10-20 year interval. To calculate the projected population for the Northern Expansion Lands, the total size of the land holding is multiplied by the average units per hectare (34 units/hectare). The sum is then multiplied by the 2.35 persons per unit count to calculate the total population projection.

5-10 year interval (Phases)

Total ha: 1.3 ha
 $1.3 \times 34 = 44$ proposed units
 $44 \times 2.35 = 104$ projected population

10-20 year interval (Phases)

Total ha: 5.7 ha
 $5.7 \times 34 = 194$ proposed units
 $194 \times 2.35 = 456$ projected population

8.4 The Future Provincial Correctional Facility (MAP ID 51)

The future Provincial Correctional Facility was identified as being within the 0-5 year interval. The estimated population is 528 people. Information obtained by the Municipality has identified the following preliminary water servicing information:

- AVDY = 3.02
- MXDY = 6.44
- PKHR = 10.34

8.5 Employment Population Projections

The Municipality had provided information on land holdings within the Kemptville urban serviced area including land size and has assigned a predicted 1-5-, 5-10-, 10-20- and 20 plus year projection for each land holding identified as commercial or industrial.

Using this information, a projected employment land population for each land holding can be calculated using the size of the land holding multiplied by a density assumption for the employment lands. There has been no additional information provided with respect to existing densities for employment lands. Therefore, an assumed density of 45 employees/hectare for employment lands has been used. This is consistent with the density assumption made for other similar sized towns located within commuting distance of the City of Ottawa, such as the Municipality of Mississippi Mills.

For this analysis, all land holdings identified by the Municipality as commercial or industrial were considered for the projected employment population, including those that are not within the Economic Enterprise or Industrial designations within the Official Plan.

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Table 29: 0 - 5 Years

Number on Map	Land size (ha)	Projected Population (Lot Size x 45 employees per hectare)
7*	0.5	23
18	0.1	5
27	1.8	83
54	1.6	70
Total	4.0	180
Total Kemptville [population centre]	3.5	157
Total Other Urban Serviced Area	0.5	23

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

Table 30: 5 - 10 Years

Number on Map	Land Size (ha)	Projected Population (Lot Size x 45 employees per hectare)
7*	2.0	92
9*	2.6	115
31*	4.8	214
32*	7.9	354
33*	0.8	36
35*	14.6	659
45*	4.6	206
57*	1.8	79
Total	39.0	1755
Total Kemptville [population centre]	0	0
Total Other Urban Serviced Areas	39.0	1755

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

Table 31: 10 – 20 Years

Number on Map	Land Size (ha)	Projected Population (Lot Size x 45 employees per hectare)
28	0.2	8
34*	3.6	163
34*	6.8	306
43*	2.5	111
Total	13.1	588
Total Kemptville [population centre]	0.2	8
Total Other Urban Serviced Areas	12.9	581

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Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

Table 32: 20 Plus Years

Number on Map	Land Size (ha)	Projected Population (Lot Size x 45 employees per hectare)
29*	2.4	110
37*	1.6	70
38*	4.0	178
39*	4.7	210
40*	11.8	532
41*	4.3	194
46	5.5	249
Total	34.3	1543
Total Kemptville [population centre]	5.5	249
Total Other Urban Serviced Areas	28.8	1294

Table Notes:

* Denotes properties outside Kemptville [population centre] designated census area

8.6 Private Services

The following properties have been identified by the Municipality as being on private servicing for the foreseeable future given the complications of extending municipal servicing across Highway 416:

- Map ID 34
- Map ID 37
- Map ID 38
- Map ID 39
- Map ID 40
- Map ID 41
- Map ID 46

9.0 Conclusion

The projected populations have been identified for each land holding that was identified by the Municipality. Based on the total projected populations for each time interval, there is considerably more potential residential capacity than required to meet the predicted population growth when using an average unit per hectare density (plus 10% for ARUs) calculated using the numbers provided by KPMG in the Long-term Population, Housing and Employment Study (December 2023). A summary of the land holdings capacity versus the projected population growth can be found in the following Table.

Existing and Future Population, Employment, and Land Use Implications and Analysis

Servicing Master Plan Update

Table 33: Projected Population Growth and Total Projected Population Growth for Land Holdings

Year Interval	Projected Population Growth ⁽¹⁾			Total Projected Population Growth ⁽²⁾			
	Kemptonville [population centre]	Other urban serviced areas	TOTAL For all urban serviced areas	For all land holdings within Kemptonville [population centre]	For all land Holding in other urban serviced areas	TOTAL For all Land Holdings in urban serviced area	TOTAL For all Land Holdings in urban serviced area with Expansion Areas
0-5	343	1383 ⁽³⁾	1726	874	1964	3366 ⁽³⁾	3366 ⁽³⁾
5-10	456	1491	1946	790	1726	2516 ⁽⁴⁾	2620
10-20	1209	2857	4066	348	9611	9959 ⁽⁵⁾	10415
20 +	864	1436	2300	1034	2366	3400 ⁽⁶⁾	12363

Table Notes:

- (2) Calculated using information from Tables 19 to 21 (using information from the KPMG report).
- (3) Calculated using information from Tables 22 to 28.
- (4) Includes population projection for the correctional facility.
- (5) Total does not include Northern Expansion Area.
- (6) Total does not include Northern Expansion Area.
- (7) Total does not include Northeast Expansion Area or Western Expansion Area.

The total projected population for each interval is summarized in the Table below.

Table 34: Projected Population for Year Interval for Kemptonville Urban Serviced Area

Year Interval	Projected Population ⁽¹⁾	Projected Population using Land Holding Capacity ⁽²⁾	Projected Population using Land Holding Capacity ⁽²⁾ with Expansion Areas
Existing ⁽³⁾	6000	6000	6000
0-5	8254 ⁽⁴⁾	9366 ⁽⁴⁾	9366
5-10	10200	11882 ⁽⁵⁾	11986
10-20	14266	21945 ⁽⁶⁾	22401
20 +	16566	25345 ⁽⁷⁾	34764

Table Notes:

- (1) Calculated using information from Table 33 and KPMG's estimated existing population of 6000 for Kemptonville.
- (2) Calculated using information from Table 31 and KPMG's estimated existing population of 6000 for Kemptonville.
- (3) Estimated population for Kemptonville identified in the KPMG report with no land holding projections.
- (4) Includes population projection for the correctional facility.
- (5) Includes population projection for the correctional facility. Calculations do not include Northern Expansion Area.

Existing and Future Population, Employment, and Land Use Implications and Analysis

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- (6) Includes population projection for the correctional facility. Calculations do not include Northern Expansion Area.
- (7) Includes population projection for the correctional facility. Calculations do not include Northeast Expansion Area or Western Expansion Area.

Table 34 provides two options of population projections. To inform the Master Servicing Plan Update, the Land Holding Capacity Population Projection is the recommended population projection to be used.

The following table summarizes the projected employee population for all commercial land holdings.

Table 35: Land Holdings and Total Projected Employment Population for Land Holdings

Year Interval	Land Size for all Land Holdings (ha)	Total Projected Employment Population for Land Holding Capacity ⁽¹⁾
0-5	4.0	181
5-10	39.0	1755
10-20	13.1	588
20 +	34.3	1543

Table Notes:

- (1) Calculated using information from Table 29 to Table 32.

There were two institutional land holdings identified by the Municipality, one for the 0-5 year interval, one for the 10-20 year interval.

Table 36: Institutional Land Holdings

Year Interval	Map ID	Land Size (ha)
0-5	16	3.9
10-20	5	4.3

There were two retirement/long term care residence land holdings identified by the Municipality for the 10-20 year interval.

Table 37: Retirement Residence Land Holdings

Year Interval	Map ID	Projected Beds	Land Size (ha)
10-20	13	150 beds	1.5
10-20	55	42 beds	1.3

Of the commercial properties identified by the Municipality, two were identified as having a potential hotel, one for the 5-10 year interval, one for the 10-20 year interval.

Existing and Future Population, Employment, and Land Use Implications and Analysis

Servicing Master Plan Update

Table 38: Commercial Properties with Hotels

Year Interval	Map ID	Projected Beds	Land Size (ha)
5-10	33	74 Beds	0.8
10-20	43	unknown	2.5

10.0 Special Notes

Institutional Lands: Lands that were identified as Institutional were not included in the population projection or employment projection calculations.

Residential Calculations: All lands that were identified by the municipality as residential or the potential for residential conversion were included in the residential population projection calculations. All housing typology and numbers for land holdings were provided by the Municipality.

Floodplain: Floodplain limits for any relevant properties were obtained from the most recent information available from the Rideau Valley Conservation Authority and excluded in the area calculations.

Per Person Per Unit: KPMG did not provide a per person per unit count for each housing typology. Therefore, the per person per unit count for each housing typology from the Municipality of North Grenville Engineering Standards for Design, Approval, and Construction, Section D, D2.05 for Domestic Demand was used with the KPMG information for required dwelling units to meet the KPMG projected populations.

11.0 References

The following documents were referenced in the creation of this report:

- Municipality of North Grenville Official Plan (2018)
- Municipality of North Grenville Long-term Population, Housing and Employment Study, dated December 13th, 2023, prepared by KPMG

12.0 Limitations

This report has been prepared by J.L. Richards & Associates Limited for the Municipality of North Grenville's exclusive use. Its discussions and conclusions are summary in nature and cannot properly be used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report is based on information, drawings, data, or reports provided by the named client, its agents, and certain other suppliers or third parties, as applicable, and relies upon the accuracy and completeness of such information. Any inaccuracy or omissions in information provided, or changes to applications, designs, or materials may have a significant impact on the accuracy, reliability, findings, or conclusions of this report.

Existing and Future Population, Employment, and Land Use Implications and Analysis

Servicing Master Plan Update

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Existing and Future Population, Employment, and Land Use Implications and Analysis

Servicing Master Plan Update



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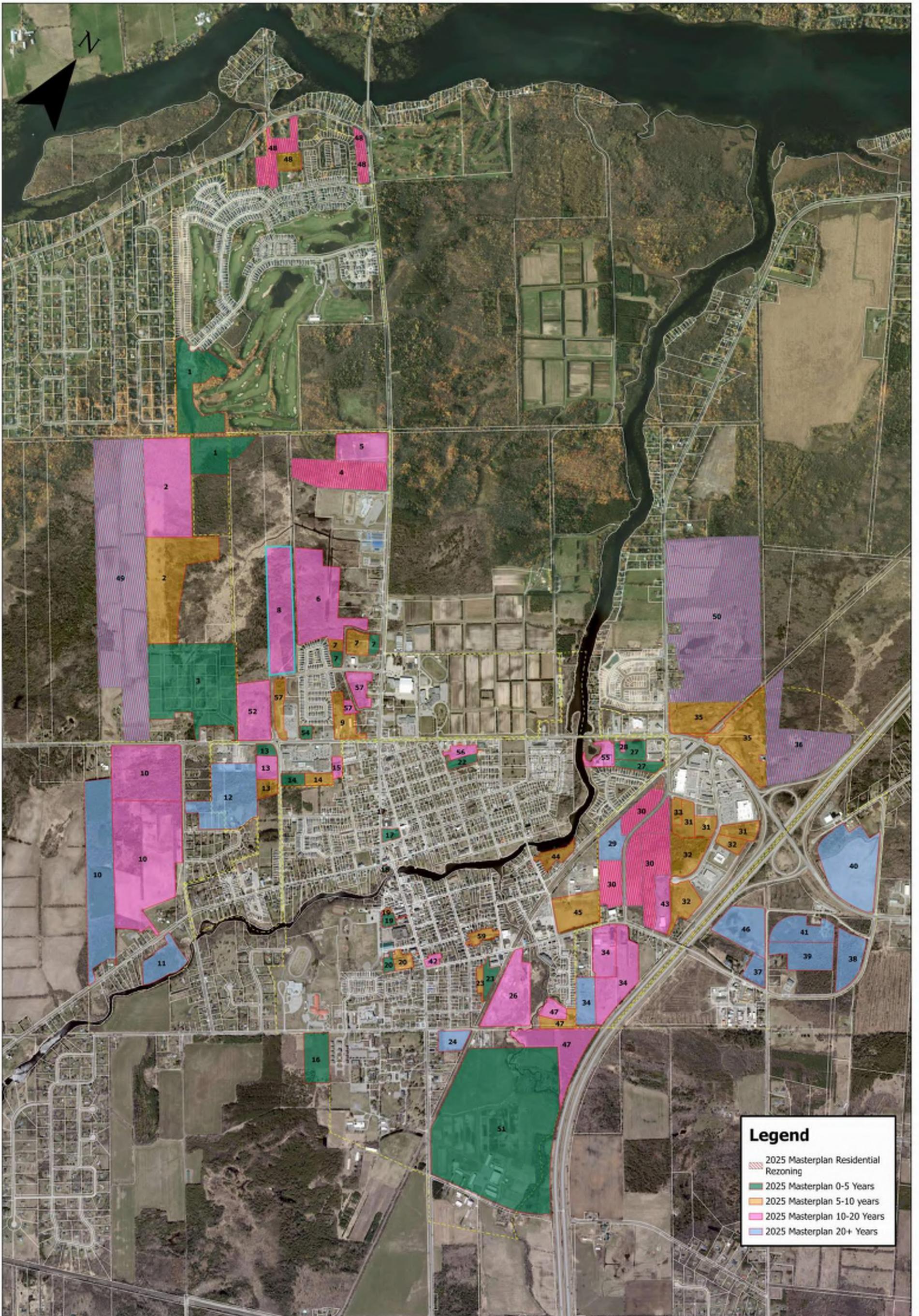
Existing and Future Population, Employment and Land Use Implications and Analysis

North Grenville Water and Wastewater Master Plan

Appendix A

Municipality of North Grenville
Servicing Masterplan

MNG Infrastructure Masterplan - Projected Developments



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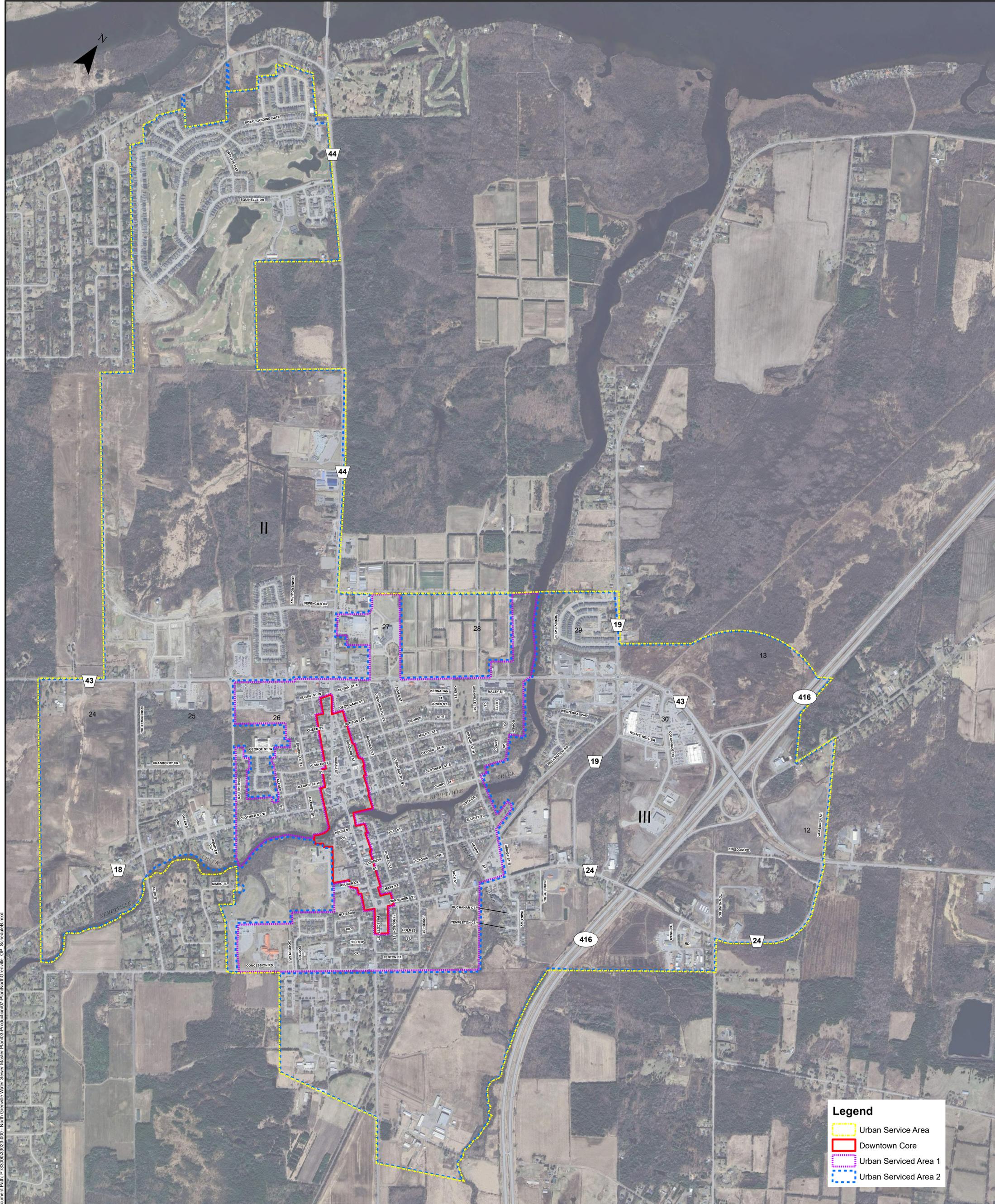
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Existing and Future Population, Employment and Land Use Implications and Analysis

North Grenville Water and Wastewater Master Plan

Appendix B

Municipality of North Grenville
Urban Serviced Area Map



Legend

- Urban Service Area
- Downtown Core
- Urban Served Area 1
- Urban Served Area 2

Phase 2 Report
North Grenville Water and Wastewater Servicing Master Plan Update

Appendix B

North Grenville Water and Wastewater Master Plan
Phase 1 Report (J.L. Richards & Associates Limited,
April 2025)

Phase 1 Report
North Grenville Water and Wastewater Master Plan

August 2025

Prepared for:

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Rev: 1

Phase 1 Report

North Grenville Water and Wastewater Master Plan

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North Grenville Water and Wastewater Master Plan

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Phase 1 Report

North Grenville Water and Wastewater Master Plan

1.0 Introduction

1.1 Background

The Municipality of North Grenville (Municipality) is comprised of a mix of rural and urban development adjacent to the southern border of the City of Ottawa. The urban settlement area of Kemptville is serviced by water and wastewater systems owned and operated by the Municipality.

The Municipality is one of the fastest growing communities in eastern Ontario, with most of the growth within the northwest quadrant of the urban area. Due to this high growth rate, the Municipality retained J.L. Richards & Associates Ltd. (JLR) in 2024 to update the Municipality's Water and Wastewater Servicing Master Plan originally published in 2010 and previously updated in 2015.

Investments in the Municipality's water and wastewater infrastructure since 2015 include:

- extending sanitary services;
- construction of a new well, pumphouse and storage facility in the East Quadrant;
- building a new sanitary pump station (SPS) in the Northwest Quadrant of Kemptville;
- and a new well and pumping station in the Northwest Quadrant.

The purpose of this Master Plan update is to provide direction for water and wastewater servicing in Kemptville for the zero (0) to five (5) year, five (5) to ten (10) year, ten (10) to twenty (20) year and build out timelines, with a focus on water distribution and storage, wastewater conveyance and pumping, and capacity needs of the water supply system and wastewater treatment plant.

1.2 Class Environmental Assessment and Master Planning

The Ontario Environmental Assessment Act (Act) sets out a planning and decision-making process to consider potential environmental effects before a project begins. The purpose of the Act is to provide for the protection and conservation of the natural environment (R.S.O. 1990, c.E.18, s.2).

The Municipal Class EA (MCEA) process is followed for common types of projects to streamline the review process while ensuring that the project meets the requirements of the Act. In 1987, the first Class EA document prepared by the Municipal Engineers Association (MEA) on behalf of Ontario Municipalities was approved under the Act. Amendments were subsequently made in 1993, 2000, 2007, 2011, 2015, and 2023.

The MCEA process includes the following stages:

- **Phase 1:** Problem and/or opportunity identification.
- **Phase 2:** Identification and evaluation of alternative solutions.
- **Phase 3:** Preparation of alternative design concepts to support a preferred solution.
- **Phase 4:** Preparation of an Environmental Study Report (ESR) for posting and review on the public record.
- **Phase 5:** Project implementation and monitoring.

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Since projects may vary in their environmental impact, they are now classified in terms of the following schedules, pursuant to the most recent amendment to the MCEA process in 2023:

- ‘Exempt’ projects, most of which were formerly classified as Schedule A and A+ projects, include various municipal maintenance, operational activities, rehabilitation works, minor reconstruction or replacement of existing facilities, and new facilities that are limited in scale and have minimal environmental effects.

While these projects are exempt from the MCEA process, proponents should consider whether notice about the project should be given or consultation on the project should be carried out. Furthermore, proponents are also responsible for obtaining any other applicable permits, approvals, and authorizations for the project.

- ‘Eligible for Screening to Exempt’ projects may be eligible for exemption based on the results of a screening process. Proponents may choose to complete the applicable screening process to determine whether the project is eligible for exemption or proceed with the applicable Schedule ‘B’ or Schedule ‘C’ process, as noted below.
- Schedule ‘B’ projects have the potential for some adverse environmental impacts and therefore, the proponent is required to undertake the first two phases of the MCEA process.

This includes mandatory consultation with Indigenous Communities, the public and other affected stakeholders as well as relevant review agencies; and the preparation of a Project File which documents the Class EA process and is placed on the public record for review and comment. If there are no outstanding concerns and the regulatory process has been completed, then the proponent may proceed to implement the project.

Generally, these projects include improvements and minor expansions to existing facilities or smaller new projects.

- Schedule ‘C’ projects have the potential for greater environmental impacts and are subject to the full MCEA process.

This includes mandatory consultation with Indigenous Communities, the public and other affected stakeholders as well as relevant review agencies; identifying, assessing, and refining alternative solutions to determine a preferred solution; and preparing the ESR which documents the Class EA process and is placed on the public record for review and comment. If there are no outstanding concerns and the regulatory process has been completed, then the proponent may proceed to implement the project.

Generally, these projects include the construction of new facilities and major expansions to existing facilities.

A Master Plan is conducted under the framework of the MEA Class EA Process. It is a planning tool that identifies infrastructure requirements for existing and future land use, through the application of environmental assessment principles, and is intended to satisfy Phases 1 and 2 of the Class EA process. The Municipal Class EA guideline identifies four (4) basic approaches of the Master Planning process, including:

- **Approach No. 1:** This approach concludes at the end of Phases 1 and 2 of the Municipal Class EA Process. With this approach, the Master Plan is being completed at a broad level of assessment and may require further detailed assessment at the project-specific level depending on the nature of the project.

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- **Approach No. 2:** This approach also concludes at the end of Phases 1 and 2 of the Municipal Class EA Process. However, the level of detail (i.e., investigation, consultation, and documentation) fulfills the requirements for Schedule 'B' projects.
- **Approach No. 3:** This approach involves the preparation of a Master Plan document at the conclusion of Phase 4 of the Municipal Class EA Process. The level of detail of the Master Plan document can fulfill requirements for Schedule 'B' and/or Schedule 'C' projects.
- **Approach No. 4:** This approach involves integration with the approvals under the Planning Act.

The North Grenville Water and Wastewater Master Plan will follow Approach No. 1, which involves the preparation of a report at the conclusion of Phases 1 and 2. The Master Plan has been completed at a broad level of assessment, which requires more detailed investigations at a project-specific level in order to fulfill the Municipal Class EA documentation requirements for any specific Schedule 'B' and 'C' projects identified within the Master Plan.

This Master Plan should be reviewed every five years to determine the need for detailed formal review and/or updates. Potential changes, which may trigger the need for an update, include:

- Major changes to the original assumptions.
- Major changes to components of the Master Plan.
- Significant new environmental effects.
- Major changes in the proposed timing of projects within the Master Plan based on changed conditions relative to the original projections/predictions.

1.3 Phase 1 Methodology & Objectives

A kickoff meeting was held between JLR and the Municipality on June 26, 2024. The Township provided available related documentation to JLR for review.

A Problem and Opportunity statement was generated from Phase 1 related work and is presented in Section 6.0 of this report.

This Phase 1 Report was prepared to summarize the findings from the first phase of the Master Plan process and to provide a basis for the identification and evaluation of alternative options during Phase 2.

Phase 1 of the Master Planning process includes the review of existing background information and identifies constraints and potential problems with the potable water and wastewater systems.

The objectives of this Report are:

- To provide a description of existing conditions and constraints associated with the potable water distribution and wastewater collection systems.
- To establish proposed design basis for future servicing needs.
- To identify land use and planning constraints, and natural environment constraints.
- To establish a Problem/Opportunity Statement; and
- To confirm Phase 2 methodology and next steps.

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1.4 Previous Studies

The following is a summary of previous studies undertaken for the Kemptville drinking water and wastewater systems:

Municipality of North Grenville, Water Pollution Control Plant and Sanitary Pump Station Optimization and Expansion Environmental Class Assessment	XCG, April 2010
Schedule "C" Municipal Class Environmental Assessment (Class EA) to develop preferred alternatives and design concepts for the expansion and upgrades to the Kemptville Water Pollution Control Plant (WPCP) to accommodate projected sewage flows over a 20-year design period.	
North Grenville Potable Water and Wastewater Master Plan Update	Stantec January 2016
The Master Plan evaluated servicing alternatives to accommodate anticipated developments to the buildout year of 2034. The Plan also identified improvements to drinking water and wastewater infrastructure to address needs of areas expected to be grow and develop.	
Municipality of North Grenville, Water Pollution Control Plant and Sanitary Pump Station Optimization and Expansion Environmental Study Report Addendum	JLR April 2019
Amendment of the 2010 Class EA ESR by filing the Water Pollution Control Plant and Sanitary Pump Station Optimization and Expansion Environmental Study Report Addendum (2019 ESR Addendum) to account for updated flow projections to 2038, new advancements in wastewater treatment technologies and changing regulatory requirements.	
Groundwater Vulnerability Study and Threat Assessment, Kemptville – Merrickville Systems	Golder Sept 2019
Update to the 2008 Groundwater Vulnerability Study of the Kemptville communal well system to include the addition of the East Quadrant Well. An updated groundwater flow model was developed to identify the wellhead protection areas (WHPA). Vulnerabilities to the source water were also identified, assessed and categorized.	
Northwest Quadrant Water Distribution System Expansion Class Environmental Assessment Study	CIMA+ March 2021
Schedule 'B' Municipal Class Environmental Assessment (MCEA), to evaluate servicing alternatives to expand the drinking water system to accommodate the anticipated growth outlined in the 2015 Master Plan Update. The preferred solution was the establishment of the Northwest Quadrant Well, storage reservoir and pumping station.	
Municipality of North Grenville, Water Pollution Control Plant and Sanitary Pump Station Optimization and Expansion Environmental Study Report Addendum	JLR January 2022
Update to the 2019 Class EA ESR Addendum to document the required rated capacity, raw wastewater quality design parameters and WPCP upgrades scope modifications that are required to accommodate the new correctional facility.	

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2.0 Study Area

2.1 Study Area Boundary

The Municipality's drinking water system is operated under the Ministry of Environment, Conservation and Parks (MECP) Municipal Drinking Water License (MDWL) Number 159-101 and Permit to Take Water (PTTW) Number 4703-C95KNP. The system is serviced by five groundwater wells, three below grade reservoirs, three above-grade reservoirs and six booster pumping stations. The groundwater wells are the Alfred Street Well, Kernahan Street Well, Van Buren Street Well, East Quadrant Well, and the Northwest Quadrant Well. There is one below grade reservoir and pumping station at each of the Alfred, Kernahan and Van Buren Street Wells. The above grade storage facilities and remaining pumping stations are located at the eQuinelle development, East Quadrant, and Northwest Quadrant. Figure 1 shows the existing water infrastructure within the Kemptville urban service area.

The Municipality's wastewater system is operated under the Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval Number 9890-CL9RJR. The system consists of four pumping stations, Bridge Street, East Quadrant, Northwest Quadrant and eQuinelle and a wastewater treatment plant (WWTP) located off County Rd 43. The 2019 Environmental Study Report for the WWTP found that the wastewater treatment system maximum day capacity of 11,370 m³/d was insufficient to meet to the projected demand from the development and is currently advancing the construction of the recommendations of the ESR which will see a maximum day capacity increase to 15,000 m³/d to service the population growth to 2038. Figure 2 shows the existing water infrastructure within the Kemptville urban service area.

2.2 Growth Projections

Population projections were established and summarized in the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report*, prepared by JLR on March 13, 2025, for the following planning periods:

- Existing conditions (2025)
- 0 to 5 year (2026 - 2031)
- 5 to 10 year (2031 – 2036)
- 10 to 20 year (2036 – 2046)
- 20+ year buildout (beyond 2046)

The report is available in Appendix A.

Based on the Statistics Canada 2021 Census of Population, the Municipality of North Grenville's population was 17,964 people, while Kemptville population centre had a population of 4,051 people. The Long-term Population, Housing and Employment Study (December 2023) identified the population of Kemptville as approximately 6,000 people in the urban service area. The discrepancy between the two figures is likely because the geographic area for Kemptville population centre does not account for the entirety of the urban serviced area of Kemptville. For the purposes of this Water and Wastewater Servicing Master Plan, the population noted in the Long-term Population, Housing and Employment Study was used as the basis for the existing population.

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The 2025 population was estimated by updating the 2021 Census population with the developments that have been constructed and serviced to date, summarized in the table below.

Table 1: Estimation of Existing Population

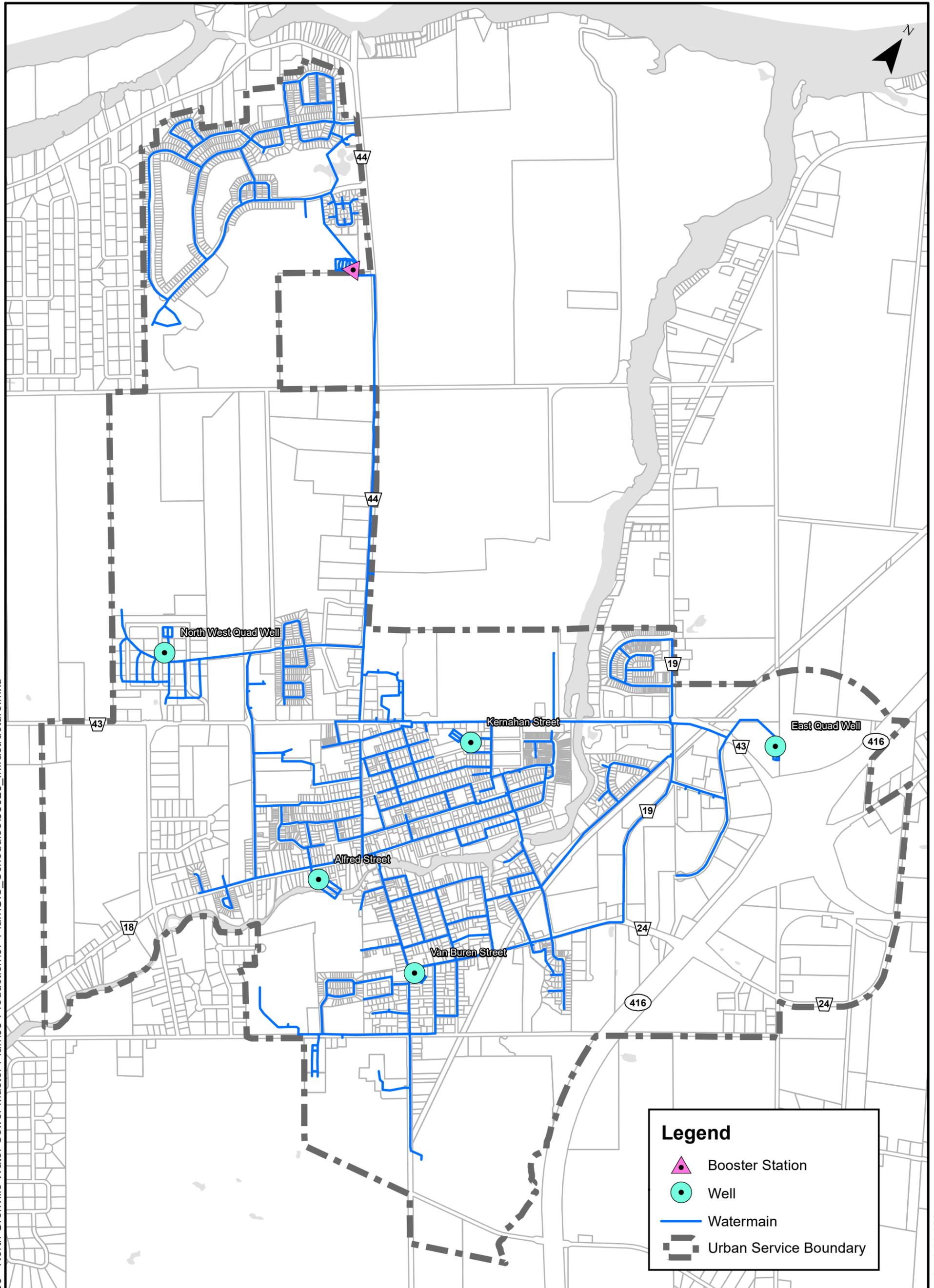
	Population
Census population – Urban Service Area (2021)	6,000
Development ID #1 (north section) Singles = 45 units Townhomes = 29 units	231
Development ID #3 Singles = 100 units Townhomes = 213 units Apartments = 120 units	1,155
Existing population (2025)	7,386

The estimated future Kemptville population in the urban serviced area was developed for each planning period in the Master Plan through consultation with the Municipality and current development applications. These estimated populations are summarized in the following table.

Table 2: Estimated Kemptville Urban Serviced Area Population

Year	Kemptville Urban Serviced Area Population
Census (2021)	6,000
Existing (2025)	7,386
0-5 year (2026-2031)	9,366
5-10 year (2031-2036)	11,986
10-20 year (2036-2046)	22,401
Buildout (beyond 2046)	34,764

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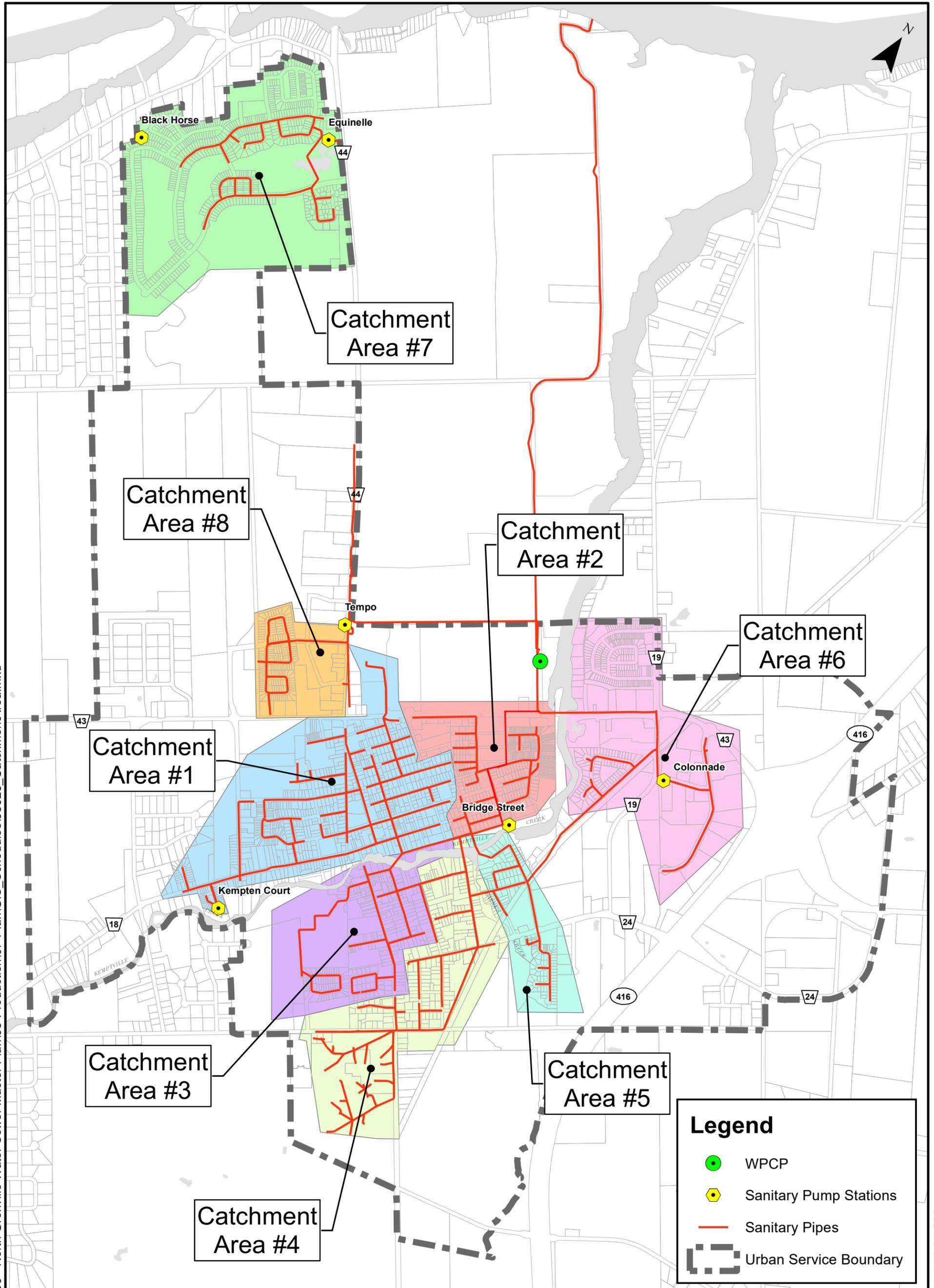
Legend

-  Booster Station
-  Well
-  Watermain
-  Urban Service Boundary

PROJECT:		North Grenville Water and Sewer Master Plan Kemptville, Ontario	
DRAWING:		Kemptville Urban Service Area - Water Infrastructure	
 J.L. Richards ENGINEERS - ARCHITECTS - PLANNERS www.jrichards.ca	This drawing is copyright protected and may not be reproduced or used for purposes other than execution of the described work without the express written consent of J.L. Richards & Associates Limited.		
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Legend

- WPCP
- ⬡ Sanitary Pump Stations
- Sanitary Pipes
- Urban Service Boundary

PROJECT:	North Grenville Water and Sewer Master Plan Kemptville, Ontario		
DRAWING:	Kemptville Urban Service Area - Wastewater Infrastructure		
<p>J.L. Richards ENGINEERS - ARCHITECTS - PLANNERS www.jrichards.ca</p>	This drawing is copyright protected and may not be reproduced or used for purposes other than execution of the described work without the express written consent of J.L. Richards & Associates Limited.		DESIGN: TR DRAWN: KTK CHECKED: MM JLR #: 33023
	DRAWING #:		Figure 2

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3.0 Natural Environment

Refer to Figure 3, which identifies significant natural environment, wetland and floodplain areas within the study area.

Limitations associated with natural environment constraints will be further explored in Phase 2.

3.1 Geology

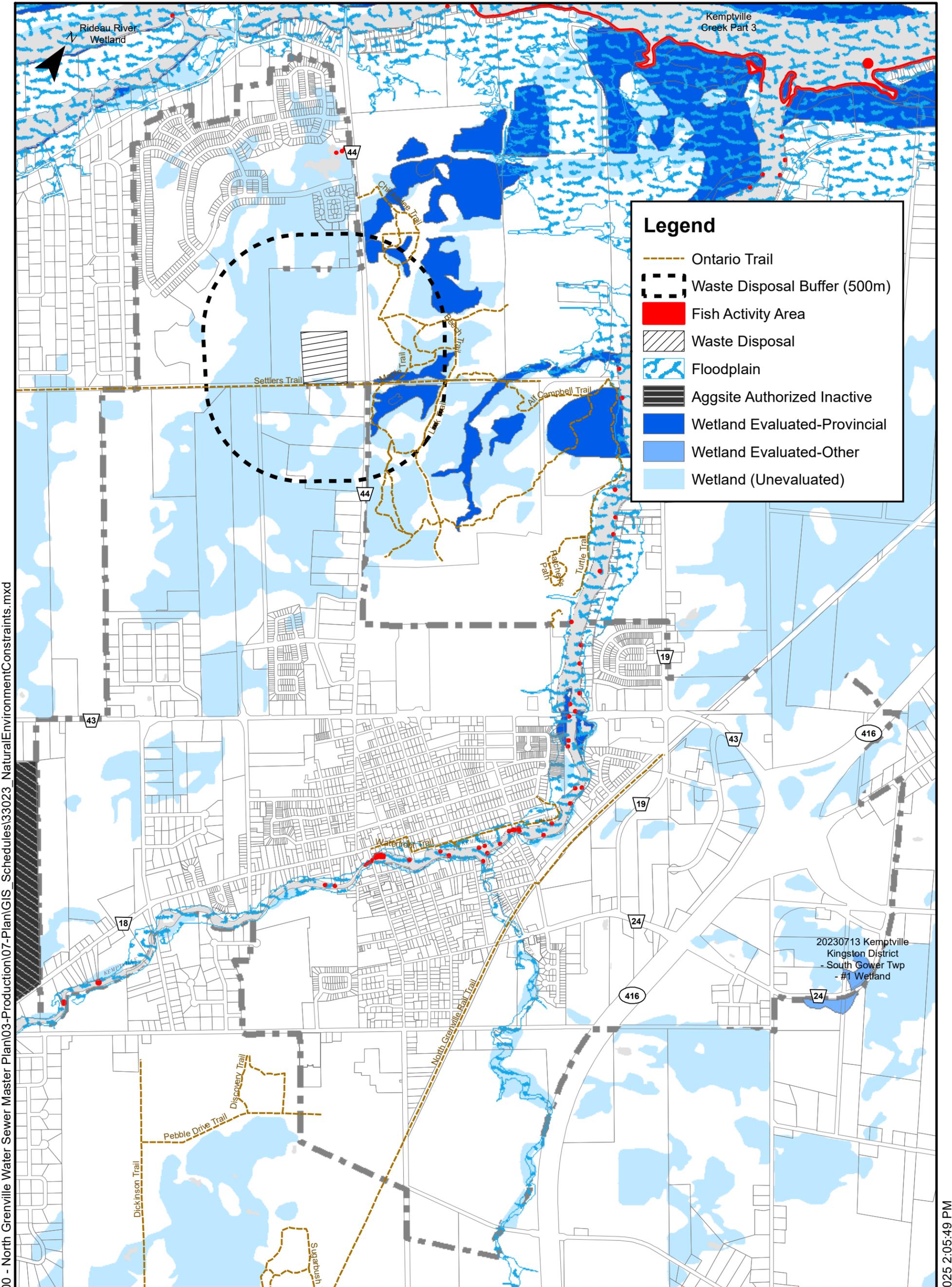
Surficial and bedrock geology of the Kemptville area is outlined in the 2019 Groundwater Vulnerability Study prepared by Golder. Refer to the study for more details.

In general, the Study area contains surficial deposits generally consisting of glacial till, offshore marine clay, and near shore fine to medium sand. Overburden thickness is generally 2-10m with local areas up to 20m. Silt and clay deposits are found in areas along Kemptville Creek and Rideau River.

3.2 Hydrogeology

Hydrogeology and groundwater information of the Kemptville area are outlined in the 2019 Groundwater Vulnerability Study prepared by Golder. Refer to the study for more details.

Groundwater supply for drinking water is primarily sourced by bedrock aquifers. Overburden aquifers with sufficient quantities for domestic use are uncommon. The shallow bedrock aquifer is present in the Oxford Formation, and is the primary source of water for private supply wells. The deep bedrock aquifer is present in the lower March formation and within the Nepean Formation, and is the primary source of water for larger commercial and municipal groundwater supply systems, including Kemptville and Merrickville. The aquifer is generally productive. Groundwater quality is generally good but hard, with localized occurrences of elevated iron, sodium, chloride and hydrogen sulphide.



Legend

- Ontario Trail
- Waste Disposal Buffer (500m)
- Fish Activity Area
- Waste Disposal
- Floodplain
- Aggsite Authorized Inactive
- Wetland Evaluated-Provincial
- Wetland Evaluated-Other
- Wetland (Unevaluated)

File Location: P:\33000\33023-000 - North Grenville Water Sewer Master Plan\03-Production\07-Plan\GIS_Schedules\33023_NaturalEnvironmentConstraints.mxd

PROJECT:	North Grenville Water and Sewer Master Plan Kemptville, Ontario		
DRAWING:	Natural Environment and Constraints		
<p>J.L. Richards ENGINEERS - ARCHITECTS - PLANNERS www.jrichards.ca</p>	This drawing is copyright protected and may not be reproduced or used for purposes other than execution of the described work without the express written consent of J.L. Richards & Associates Limited.		DESIGN: AG DRAWN: KTK CHECKED: MM JLR #: 33023
	DRAWING #:		Figure 3

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4.0 Potable Water Distribution System

4.1 Existing Potable Water Supply

The Municipality's drinking water system is serviced by five groundwater wells: the Alfred Street Well, Kernahan Street Well, Van Buren Street Well, East Quadrant Well, and the Northwest Quadrant Well. Each drilled well is protected by a stainless steel casing and equipped with a submersible well pump. Duty/standby metering pumps inject sodium hypochlorite into the raw water before it enters a storage reservoir for contact time. Duty/standby centrifugal pumps discharge the treated water into the distribution system. The wells are authorized under the Ministry of the Environment, Conservations and Parks (MECP) Permit to Take Water (PTTW) No. 5856-C8ZQ57. The combined PTTW daily water taking limit of all the Municipality's wells is 10,460.24 m³/d.

Table 3: Historical Raw Water Demands (2019 to 2023)

Year	Average Day Demand (m ³ /d)	Maximum Day Demand (m ³ /d)	Max Day Factor
2019	1967	2944	1.5
2020	1808	2871	1.6
2021	1816	3321	1.8
2022	2090	3446 ⁽¹⁾	1.6
2023	1817	2614	1.4
Overall	1900	3446	1.8

Notes:
 (1) Single day max on October 26, 2022 (4,184 m³/d) removed as an outlier.

As seen in Table 3, the overall average day potable water demand is 1,900 m³/d, and the maximum day demand is 3,446 m³/d. This maximum day demand is roughly 33% of the PTTW limit.

4.2 Historical Potable Water Demands

The Kemptville Drinking Water System operates under Municipal Drinking Water License (MDWL) No. 159-201, with a combined rated capacity of 6,819.92 m³/d, with includes the Alfred Street, Van Buren Street, Kernahan Street and East Quadrant subsystems. With the addition of the new Northwest Quadrant system in 2022, the combined rated capacity is 8,807.12 m³/d. With the largest subsystem (East Quadrant) out of service, the total system capacity is 6,621.12 m³/d.

Table 4: Drinking Water Treatment Subsystem Rated Capacities

Treatment Subsystem	Rated Capacity (m ³ /d)
Alfred Street	1,961.28
Van Buren Street	1,363.68
Kernahan Street	1,308.96
East Quadrant	2,186.00
Northwest Quadrant	1,987.20

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Treatment Subsystem	Rated Capacity (m ³ /d)
Total MDWL Rated Capacity	8,807.12
Total System Capacity (largest subsystem out of service)	6,621.12

The historical treated water demands provided by the Municipality are summarized below:

Table 5: Historical Treated Water Demands (2019 to 2023)

Year	Average Day Demand (m ³ /d)	Maximum Day Demand (m ³ /d)	Maximum Day Factor
2019	1965	2859	1.5
2020	1815	2749	1.5
2021	1806	2661	1.5
2022	2082	3449 ⁽¹⁾	1.7
2023	1802	2684	1.5
Overall	1894	3449	1.8
Notes:			
(1) Single day max on October 26, 2022 (4,205 m ³ /d) removed as an outlier.			

As seen in Table 5, the overall average day potable water demand is 1,894 m³/d, and the maximum day demand is 3,449 m³/d. This results in an overall maximum day factor of 1.82 times the average day demand. This maximum day demand is roughly 39% of the MDWL total rated capacity and roughly 52% of the total system capacity with one well subsystem out of service.

4.3 Potable Water System Design Criteria

Table 4 summarizes the water demand rates used to evaluate the Municipality's potable water system.

Table 6: Design Criteria - Water Demand Rates

Land Use	Design Criteria	Maximum Day Factor ⁽¹⁾
Existing Residential ⁽¹⁾	256.4 L/cap/day	1.82
Future Residential ⁽¹⁾	256.4 L/cap/day	1.82
Future Commercial ⁽²⁾	28,000 L/ha/day	1.82
Future Industrial ⁽³⁾	35,000 L/ha/day	1.82
Future School ⁽⁴⁾	70 L/student/day	1.82
Future Hotel ⁽⁴⁾	225 L/bed/day	1.82
Future Retirement Home ⁽⁵⁾	256.4 L/bed/day	1.82
Notes		
(1) Historical Flow Analysis		
(2) MECP Drinking Water Design Guidelines 3.4.3		

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Land Use	Design Criteria	Maximum Day Factor ⁽¹⁾
(3) MECP Drinking Water Design Guidelines 3.4.4		
(4) MECP Drinking Water Design Guidelines Table 3-2		
(5) Assumed residential ADD		

Peak hour factors are based on Table 3-1 of the MECP Drinking Water Design Guidelines, based on population.

4.4 Future Potable Water Demands

The following table summarizes the existing and future water demands:

Table 7: Existing and Future Water Demands

Demand Scenario	Existing Conditions (2025) ⁽³⁾	Short-Term	Mid-Term	Long-Term	Build-Out
		(2026-2031)	(2031-2036)	(2036-2046)	(beyond 2046)
Population Growth	0	1,452	2,620	10,415	12,363
Total Served Population ⁽¹⁾⁽²⁾	7,386	8,838	11,458	21,873	34,236
ICI - Commercial Development Area (ha)		4.0	39.1	17.9	22.5
ICI - Retirement Home (No. Beds)		-	-	192.0	-
ICI - School (No. Students)		417			
ICI - Hotel (No. Beds)		-	74.0	-	-
ICI - Industrial Development Area (ha)		-	-	-	11.8
ICI - Correctional Facility					
Average Day (m ³ /day)		261	-	-	-
Max Day (m ³ /day)		556	-	-	-
Peak Hour (m ³ /day)		893	-	-	-
Average Day (m ³ /day) - Residential		372	672	2,671	3,170
Average Day (m ³ /day) - ICI		402	1,111	550	1,043
Average Day (m ³ /day) - Total	1,894	2,668	4,452	7,672	11,885
Maximum Day (m ³ /day)	3,449	4,941	8,188	14,053	21,726
Peak Hour (m ³ /day)	5,682	8,116	13,198	22,377	33,752

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Demand Scenario	Existing Conditions (2025) ⁽³⁾	Short-Term	Mid-Term	Long-Term	Build-Out
		(2026-2031)	(2031-2036)	(2036-2046)	(beyond 2046)
Notes					
(1) The total serviced population represents residential population only and excludes equivalent institutional households and populations.					
(2) Total population excludes correctional facility population (528 persons) as demands are identified separate from residential flows.					
(3) Population of 6000 as of 2021 with addition of recently built developments.					

Figure 4 represents the projected maximum day water demand and anticipated timing to reach the System Capacity (with the largest well subsystem out of service), the MDWL rated capacity and the PTTW limit. With the largest well system out of service, 80% of the system capacity will be reached in 2031, and 100% in 2033. Regarding the MDWL rated capacity, 80% will be reached in 2034, and 100% will be reached in 2036. The PTTW limit will be reached by 2039.

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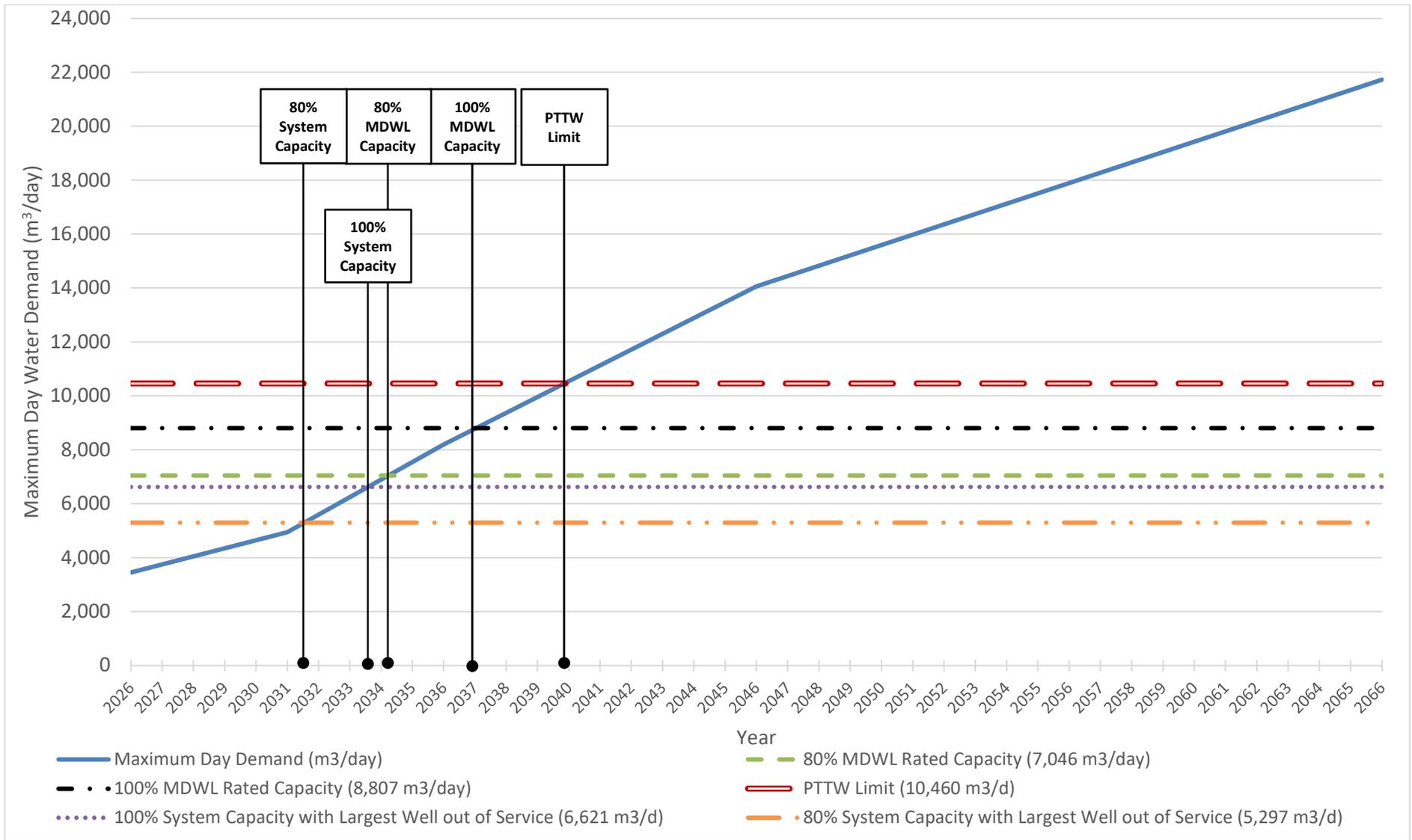


Figure 4: Projected Max Day Drinking Water Demand

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4.5 Future Water Storage Requirements

The Kemptville Drinking Water System has six (6) at-grade storage reservoirs, The following table summarizes the available storage at each of these reservoirs.

Table 8: Existing Reservoir Storage

Reservoir	Effective Storage Volume (m3)
Alfred	801
Van Buren	880
Kernahan	900
eQuinelle	1,176
East Quad	1,370
Northwest Quad	1,370
Total	6,497

Per MECP Design Guidelines for Drinking-Water Systems (2008), total available treated water storage within the system should at least amount to the sum of the required equalization storage (B), fire storage (A), and emergency storage (C) allowances, as depicted in Figure 5.

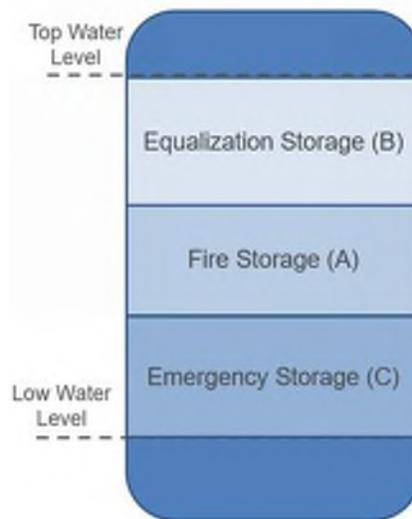


Figure 5: Total Required Treated Water Storage

Based on these guidelines, Table 9 provides a summary of the estimated existing, short, mid, and long-term and build-out total storage requirements for Kemptville. Note that the equivalent population in the table is not equal to the service population as used in previous sections of this report. The service population is the number of residents living in the Kemptville urban serviced

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area. The equivalent population considers contributions from residential and ICI water demand and was calculated using the following equation:

$$\text{Equivalent Population} = \frac{\text{Average Day Demand}}{\text{Average Per Capita Water Consumption}}$$

Based on the available information, the existing treated water storage volume is sufficient for the existing demand. It is anticipated that the storage capacity will be insufficient for water demand in the mid-term projections. Additional modelling will be completed in Phase 2 of the Master Plan to incorporate future development growth and investigate storage pressure constraints.

Table 9: Future Water Storage Requirements

Parameter	Existing (2025)	Short-Term (2026-2031)	Mid-Term (2031-2036)	Long-Term (2036-2046)	Build-out (2046+)
Cumulative Equivalent Population ⁽¹⁾	7,386	10,406	17,361	29,921	46,352
Fire Flow ⁽²⁾ (L/s)	169	193	252	333	405
Duration ⁽²⁾ (Hours)	3.0	3.0	4.0	5.3	6.9
A – Fire Storage ⁽³⁾ (m ³)	1,829	2,087	3,668	6,337	10,077
B – Equalization Storage ⁽⁴⁾ (m ³)	862	1,235	2,047	3,513	5,431
C – Emergency Storage ⁽⁵⁾ (m ³)	673	830	1,429	2,463	3,877
TOTAL STORAGE REQUIREMENT (m³)	3,365	4,152	7,144	12,313	19,385
EXISTING AVAILABLE STORAGE (m³)	6,497	6,497	6,497	6,497	6,497
Deficit (m ³)	None	None	647	5,816	12,888

Notes

(1) Estimated to be equal to average day demand / per capita usage of 256.4 L/cap/d. The equivalent population also includes ICI flow contribution.

(2) Values interpolated from Table 8-1 of the MECP Design Guidelines (2008) based on equivalent service population. Fire flow is described as the largest expected fire flow requirement in L/s and duration is length of time fire flow shall be sustained. A sensitivity analysis was completed to compare fire flow by MECP and Fire Underwriters Survey (FUS) methods. Using FUS method, Table 8, exposure distance of less than 3 m for row housing, it generates a fire flow of 9,000 L/min or 150 L/s. The MECP method generates a more conservative estimate for fire flow and is representative of holistic approach for a

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Parameter	Existing (2025)	Short-Term (2026-2031)	Mid-Term (2031-2036)	Long-Term (2036-2046)	Build-out (2046+)
drinking water distribution system. As such, MECP fire flow numbers are being used for future water storage requirement calculations.					
(3) Largest expected fire volume = fire flow x duration					
(4) 25% of Maximum Day Demand					
(5) 25% of the sum of 'A' and 'B'					

Figure 5 represents the projected storage volume requirements and anticipated timing to reach 80% and 100% of available storage. Based on the projected growth, 80% capacity will be reached in 2033, and 100% capacity will be reached in 2034.

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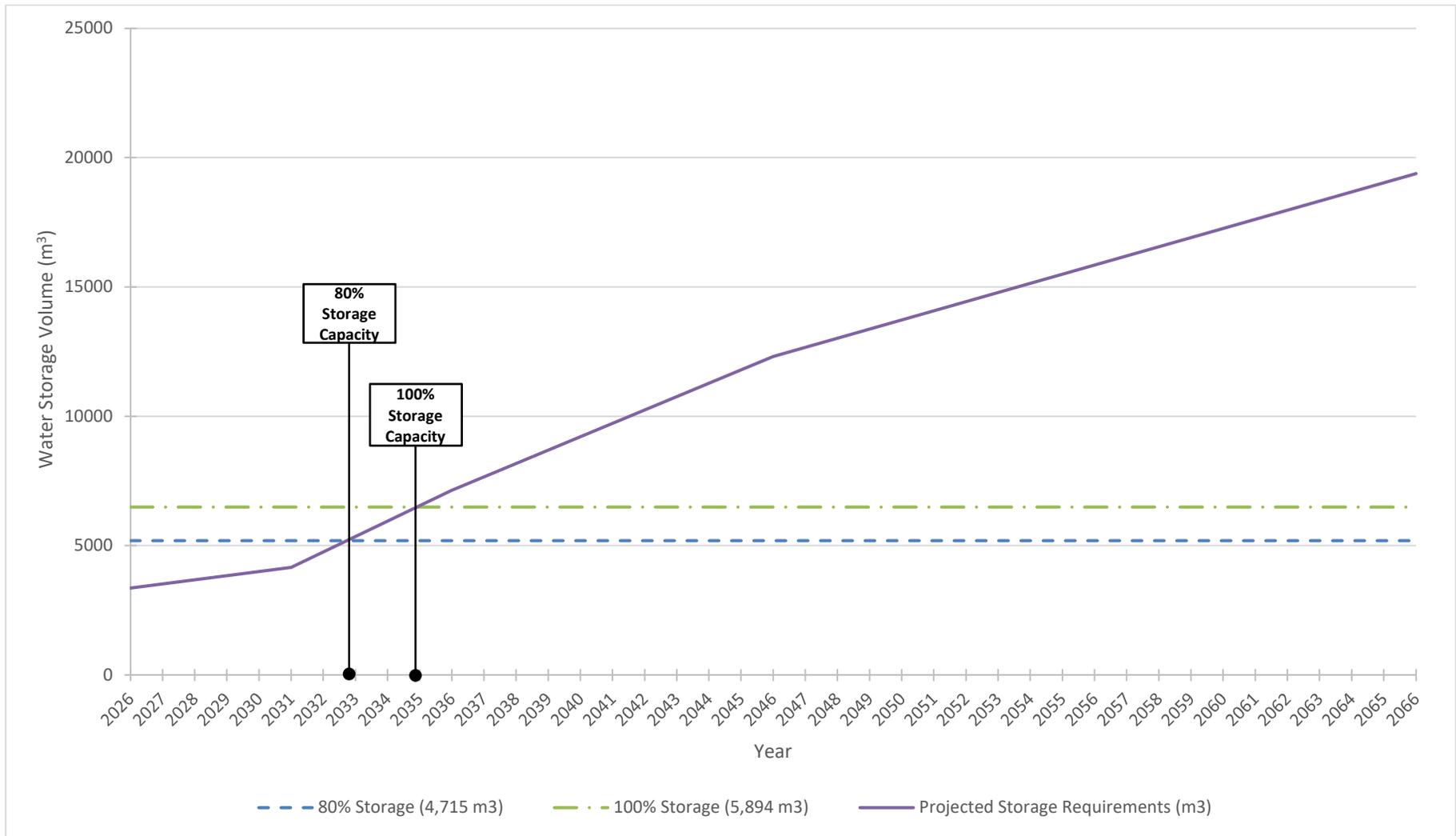


Figure 6: Projected Drinking Water Storage Volumes

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4.6 Hydraulic Water Model Update

The Hydraulic Water Model for the Municipality was previously updated in 2020. In support of the current Master Plan, the water model was updated based on existing conditions and the future growth scenarios. The modelled scenarios include existing conditions for the year 2025 given the historical metered water demand data and recently completed developments, short-term (0-5 years) from 2026 to 2031, mid-term (5-10 years) from 2031 to 2036, long-term (10-20 years) from 2036 to 2046, and build-out (20+ years) from 2046 onward.

4.6.1 Existing Watermain Network

The existing conditions scenarios were taken from the previous 2020 model and were updated based on information provided by the Municipality via comments (refer to Appendix B) and engineering design drawings for new development areas and pipe upgrades. Pressure reducing valve (PRV) settings and the static elevations of water reservoirs were not changed from the previous model. The following Hazen-Williams friction loss coefficients (C-factors) in the table below were used for all new pipes added:

Table 10: Roughness Coefficients based on Pipe Diameter

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120

The following updates were made to the watermain network for existing conditions:

- Kemptville College Campus CEPEO
 - Added 200 mm and 100 mm water services to two (2) buildings including the administration building and the Rorke Hall.
 - Junction elevations were obtained from the contour lines on the engineering drawing.
 - Lengths of the two (2) services were manually measured and added to the model based on the scaled engineering drawing.
- Reuben Crescent
 - Existing pipe upgraded to 200 mm.
- Concession Road
 - Existing pipe upgraded to 200 mm between the intersection of Concession Road and Prescott Street and the intersection of Concession Road and Dr Gordon Crescent.
- Bowen and Maley Looping
 - Watermain loop added between Bowen Crescent and Maley Street.

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- County Road 43
 - Existing pipe upgraded to 300 mm from the section of pipe between the intersection of County Road 43 and James Street and the intersection of County Road and King Street.
- eQuinelle Phases 5 and 6
 - Junction and hydrant elevations as well as pipe sizes added per drawings provided.
- Oxford Village
 - Assumed 300 mm connection to existing watermain on Depencier Drive
 - Junction and hydrant elevations as well as pipe sizes added per drawings provided.
- County Road 43
 - Updated the watermain loop near the intersection of County Road 43 and County Road 44 per the Municipality Markup.
- Victoria Avenue
 - Updated watermain between Victoria Avenue and Asa Street to a 100 mm pipe per Municipality Markup.
- Wellington Road
 - Updated watermain to a 150 mm from the intersection of Wellington Road and Bridge Street to the intersection of Wellington Road to Westerra Way.

4.6.2 Northwest Quadrant Pumping Station

The recently constructed Northwest Quadrant Pumping Station was added to the model based on the *Northwest Quadrant Water System Kemptville, Issued for Building Permit Application* drawing set (CIMA+, April 2021) and *Design Report for the Northwest Quadrant Water Distribution System Expansion* (CIMA+, April 2021). The information presented in this section was based on these documents.

The site includes a well, a water storage reservoir, and the pumping station equipped with two (2) high lift pumps and one (1) high flow pump. These pumps are only designed to supply a portion of the design flow requirements for the Kemptville Drinking Water System.

As the water model is intended to evaluate the distribution system, the Northwest Quadrant Pumping Station was modelled schematically and simplified to exclude the well and well pump. A static reservoir was modelled at the low water level of 97.40 m (i.e. the level at which the reservoir starts to fill) to conservatively represent the water storage reservoir. The high lift pumps and high flow pump draw water from this reservoir to discharge to the system. The high lift pumps are identical and were modelled with Variable Frequency Drives (VFDs) to target a discharge pressure of 535 kPa per the CIMA+ report. Suction and discharge piping into and out of the pumps was modelled representatively in terms of diameters and lengths. A Flow Control Valve (FCV) was modelled at the pumping station discharge to ensure the model did not exceed the pump

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capacity for each scenario as outlined in the Model Simulation Results Section. Minor losses within the pumping station were not included in the model.

The following setpoints and inputs were modelled at the pumping station:

Table 11: Northwest Quadrant Pumping Station

Description	Model Input
Storage reservoir water level	97.40 m (60% full)
Pump elevations	94.06 m
Pump curves	Refer to Appendix B
Pump discharge pressure target (VFD input)	535 kPa at J373
Suction piping	200 mm diameter, C=110, Length 5.15 m
Discharge piping	150 mm diameter, C=100, Length 9.00 m

It is noted that VFDs are not modelled at the other existing pumping stations except at East Quadrant Pumping Station.

4.6.3 Existing Water Demands

Per the above Section 4.2, the Municipality’s Treated Daily Flow data over five (5) years (2019 to 2023) was used to determine the total average day, maximum day and peak hour water demands for the system, and for both pressure zones separately. The data was averaged to determine a total existing (2023) average day demand of 1,894 m³/day (Kemptonville zone 1,731 m³/day, eQuinelle zone 163 m³/day). The Municipality also provided a list of the annual high-water users, and the top ten (10) highest water user demands were manually input in the water model at the nearest junction node. Based on the available data, the ten (10) highest water users accounted for 251 m³/day of water consumption, which represents approximately 13% of the overall average day consumption for the community.

The eQuinelle pressure zone was calculated to have an average day demand of 163 m³/day based on the average of the data provided for 2020 – 2023 (no water data was provided for eQuinelle BPS in 2019). To determine the maximum day demand, an average day to maximum day peaking factor of 1.82 for the Kemptonville zone and 1.60 for the eQuinelle zone was used, which was calculated based on the actual 2019 - 2023 data for Kemptonville and 2020 – 2023 data for eQuinelle. The maximum day demand of 261 m³/day for eQuinelle was taken to be the maximum day across the four years (December 1st, 2022). Similarly, a peaking factor of 3.0 multiplied by average day demand was used to establish the peak hour demand, which is consistent with the Ministry of the Environment, Conservation and Parks (MECP) Guidelines given an existing population of 7,386 people. This population is within the 3,001 – 10,000 population range outlined in MECP. The table below summarizes the water demands for existing conditions that have been incorporated into the model. Refer to Appendix B for a detailed summary of the updated model demands.

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Table 12: Water Demands under Existing Conditions

Demand Scenario	Demand (L/s)		
	Kemptville Zone	eQuinelle Zone	Total
Average Day	20.04	1.88	21.92
Maximum Day	36.91	3.01	39.92
Peak Hour	60.11	5.65	65.76

4.7 Future Conditions Modelling

4.7.1 Future Watermain Network

The watermain network was updated for all future growth scenarios including short-, mid-, long-term and build-out scenarios based on the populations and areas outlined in the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report* (March 13, 2025). The following assumptions were applied to the watermain network for all future growth scenarios:

- All future watermains consist of 200 mm diameter pipes with a material of PVC as there were no engineering drawings provided for any future developments.
- All elevations of the proposed junctions in future growth scenarios were based on the latest LiDAR data (dated 2025).
- All subdivisions consist of a looped watermain connection with a minimum of two (2) connections to the existing water network per the *Municipality of North Grenville's Engineering Standards for Design, Approval, and Construction*, dated August 2022. Connections were made to the existing system only where necessary to illustrate the capacity of the current system to support development and determine the need for upgrades and additional watermains.
- A closed Pressure Reducing Valve (PRV) was implemented in the water model under Mid Term, Long Term and Build Out conditions to delineate the two (2) pressure zones: Kemptville and eQuinelle.

4.7.2 Future Water Demands

For all future growth scenarios, demands were applied at a representative junction located either at the center of the proposed development or at the furthest junction from the existing watermain network depending on the pipe layout, to be conservative. Demands were calculated based on the areas and population number and densities outlined in the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report* (JLR, March 13, 2025). The design parameters used to calculate the demands under all future growth scenarios are summarized in the table below (refer to Appendix B):

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Table 13: Flow Calculation Design Parameters for Existing Condition Updates and Future Growth Scenarios

Design Parameter	Value	Unit	Source
Single House Density	3.4	Person/unit	<i>Existing and Future Population, Employment, and Land Use Implications and Analysis Report (JLR, March 13, 2025)</i>
Townhouse/Semi-Detached Density	2.7	Person/unit	
Apartment Density	2	Person/unit	
Unknown Residential Type Density	2.35	Person/unit	
Average Day Demand - Residential	256.4	L/cap/d	Table 6: Design Criteria - Water Demand Rates
Average Day Demand - General Commercial	28000	L/d/ha	
Average Day Demand - Light Industrial	35000	L/ha/d	
Average Day Demand - Retirement Home	260	L/d/bed	
Average Day Demand - Hotel	225	L/d/bed	
Average Day Demand - Institution (Schools)	70	L/students/d	
Maximum Day Demand - Peaking Factor	1.82	x ADD	
Peak Hour Demand - Peaking Factor Existing and Short-Term	3.00	x ADD	
Peak Hour Demand - Peaking Factor Mid-Term and Long-Term	2.85	x ADD	
Peak Hour Demand - Peaking Factor Build-Out	2.70	x ADD	

The following assumptions were applied to the demand calculations for all future growth scenarios:

- Future developments labeled as commercial/industrial per the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report (JLR, March 13, 2025)* were assumed to be commercial only. Therefore, the average day demand for commercial developments was applied.
- Future developments labeled as residential/commercial per the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report (JLR, March 13, 2025)* were assumed to be residential only. Therefore, the average day demand for residential developments was applied.

The table below summarizes the total water demands under all future growth scenarios including short-, mid-, long-term, and build-out scenarios. The following table summarizes the detailed demands per each scenario and term which were calculated in excel per the design parameters outlined in the table above and implemented in the water model (Refer to Appendix B).

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Table 14: Total Water Demand per Future Growth Scenario

Demand Scenario	Short-Term (0-5 years) (L/s)	Mid-Term (5-10 years) (L/s)	Long-Term (10-20 years) (L/s)	Build-Out (20+ years) (L/s)
Average Day	30.88	51.52	88.79	137.55
Maximum Day	57.20	94.79	162.63	251.37
Peak Hour	93.93	152.79	259.02	390.68

4.8 Water Distribution System Design Criteria

The existing and growth scenarios for the Municipality were evaluated in accordance with the *Municipality of North Grenville's Engineering Standards for Design, Approval, and Construction*, dated August 2022 (herein referred to as the Municipality's Engineering Standards). As per the Municipality's Engineering Standards, it is recommended that all new watermains for new subdivisions be looped with a minimum of two (2) connections to the existing watermain system to eliminate dead-end sections.

The Municipality's Engineering Standards also specify that fire flow requirements must comply with the guidelines outlined in the *Water Supply for Public Fire Protection, Fire Underwriters Survey (F.U.S.)*, dated 2020. For residential dwellings of detached single family and small two-family units not exceeding two stories in height and having a total effective area of not more than 450 m², the F.U.S. suggests the following fire flows:

Table 15: F.U.S. Suggested Required Fire Flows

Exposure Distance	Wood Frame L/s (L/min)	Masonry or Brick L/s (L/min)
Less than 3 m	133 L/s (8,000 L/min)	100 L/s (6,000 L/min)
3 to 10 m	67 L/s (4,000 L/min)	67 L/s (4,000 L/min)
10.1 to 30 m	50 L/s (3,000 L/min)	50 L/s (3,000 L/min)
Over 30 m	33 L/s (2,000 L/min)	33 L/s (2,000 L/min)

A review of residential units' exposure distances appears to indicate that most units are between three to ten metres apart with some less than three metres, particularly in new development areas. Therefore, fire flow requirements would range from 67 L/s to above 100 L/s, depending on unit exposure, occupancy, and construction.

The Ministry of the Environment, Conservation and Parks (MECP) recommends a minimum pressure of 276 kPa (40 psi) under peak hour demand, and a maximum pressure of 689 kPa (100 psi). The Municipality advised to use the MECP pressure requirements for the water model.

The Municipality noted that some areas in their system may not be able to meet F.U.S. fire flows. On a case-by-case basis, depending on the location of the proposed developments and the capability of the water system meeting F.U.S., the Municipality may consider Ontario Building Code (O.B.C.) fire flow as the minimum requirement.

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4.9 Model Simulation Results

The water model was configured to simulate the following scenarios under existing, short term, mid term, long term, and build out demand conditions:

- Average Day
- Peak Hour
- Maximum Day plus Fire Flow

In order to assess these scenarios in the model, the pump configurations were adjusted (i.e. which pumps were operating) to meet the future growth demands. This approach was necessary in order to obtain valid model results and to confirm that an upgrade in pumping capacity was needed in the future. If a specific configuration caused the model to be unbalanced, then a different configuration was attempted. For all scenarios, a configuration of existing system pumps was explored before introducing a new proposed pump. There may be other feasible configuration options to those presented in this section. The pump configurations and capacities will be further refined and assessed in Phase 2 of the Master Plan.

The results of the model simulations are summarized in the Figures below, where the percentage of junction nodes within each applicable range is depicted on the figure. The model schematic results are included in Appendix B.

Average Day Demand

The average day demand conditions were simulated to assess the system pressures expected throughout the Municipality. The table below provides a summary of the system operating conditions used in the model for each scenario that was included in this assessment. The table summarizes the pump configurations, the Pressure Reducing Valve (PRV) status at PRV-6 which was used in the model to delineate the two (2) pressure zones (boundary between Kemptville zone and eQuinelle zone), and the Flow Control Valve (FCV) status at FCV-4 which was modelled on the Northwest Quadrant Pumping Station discharge line.

Table 16: Operating Conditions under Average Day Demand

Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
Existing (EX)	<ul style="list-style-type: none"> • Duty Pump 1 is ON at all Pump Stations • eQuinelle PMP-1 is operating. 	Inactive	Inactive
Short Term (ST)	<ul style="list-style-type: none"> • Duty Pump 1 is ON at all Pump Stations • eQuinelle PMP-1 is operating. 	Inactive	Active at 23.7 L/s
Mid Term (MT)	<ul style="list-style-type: none"> • Duty Pump 1 is ON at all Pump Stations • eQuinelle PMP-1 is operating 	Closed	Active at 23.7 L/s
Long Term (LT)	<ul style="list-style-type: none"> • Duty Pump 2 is ON at all Pump Stations except East Quadrant 	Closed	Active at 23.7 L/s

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Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
	<ul style="list-style-type: none"> East Quadrant Pump Station is not operating. eQuinelle PMP-2 active 		
Build Out (BO)	<ul style="list-style-type: none"> Duty Pump 2 is ON at all Pump Stations except Kernahan East Quadrant Fire is operating. Kernahan Fire is operating. eQuinelle PMP-2 is operating 	Closed	Active at 23.7 L/s

It is noted that under existing conditions, only Northwest Quadrant Duty Pump 1 supplied the Kemptville zone when the model was run. It is recommended the Municipality confirm this operation based on current system data. eQuinelle PMP-2 was required in the Long Term and Build Out scenarios as the total demand in eQuinelle exceeded the PMP-1 capacity. In the Build Out scenario, two (2) high-capacity pumps were required along with duty pumps to supply the demand. It is also noted that FCV-4 must remain inactive in the existing average day scenario in order for the model to compute properly.

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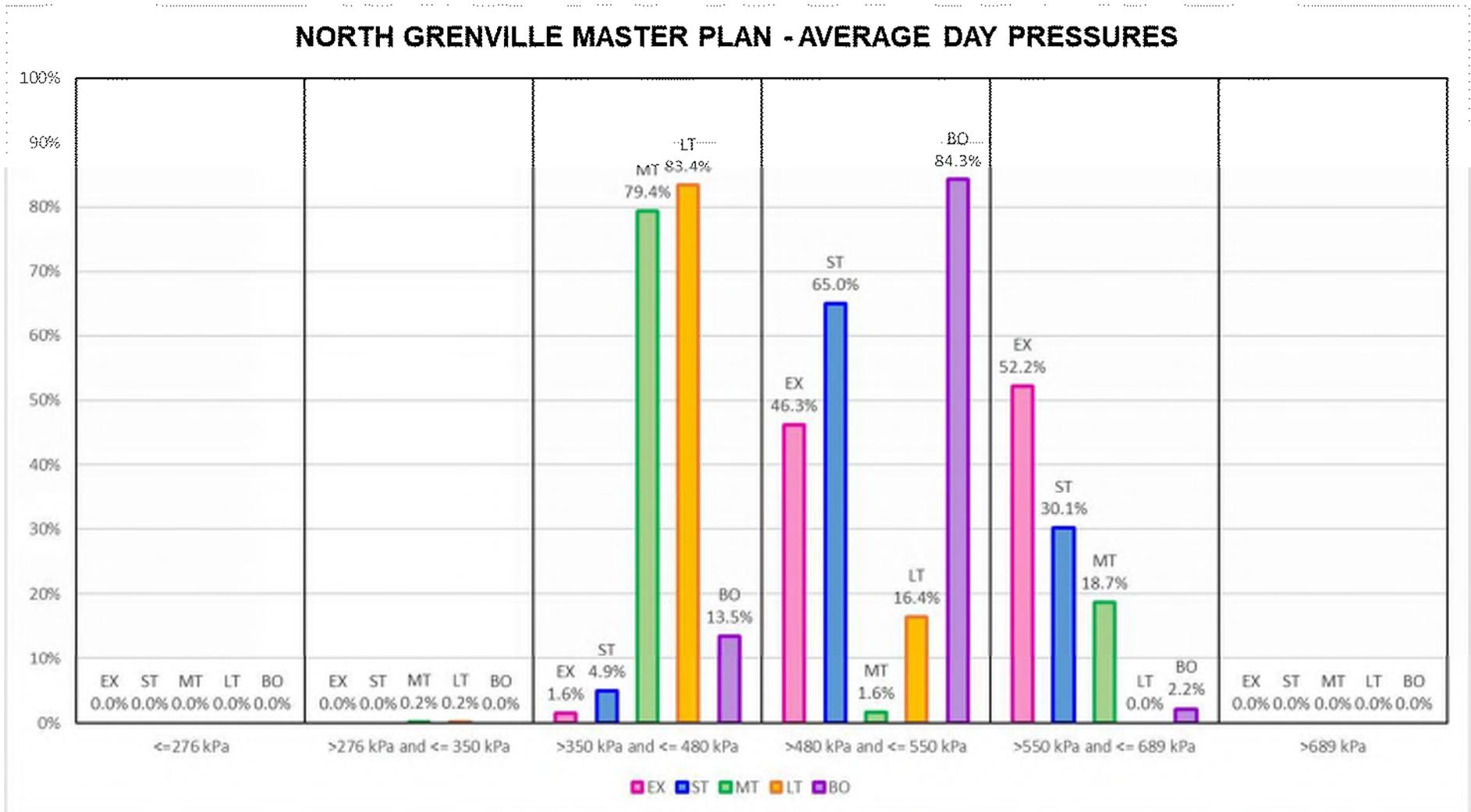


Figure 7: Pressures under Average Day Demand for Each Scenario

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Under average day demand for existing conditions, the simulation pressures were found to range from 449 kPa to 625 kPa. In the Kemptville pressure zone, the results generally fall within or slightly exceed the normal operating pressures of 350 kPa to 550 kPa, as per the Municipality's Engineering Standards. The maximum pressure expected in the Kemptville pressure zone is 596 kPa, which is less than the maximum pressure of 689 kPa (100 psi) as recommended by the MECP Guidelines but exceeds 550 kPa as per the Municipality's Engineering Standards. In the eQuinelle pressure zone, the pump produces pressures that range from 584 kPa to 625 kPa, which remains below the maximum pressure of 689 kPa (100 psi) as recommended by the MECP Guidelines but exceeds 550 kPa as per the Municipality's Engineering Standards. It should be noted that a pressure of 33 kPa was simulated at Junction J220, which represents the suction side of the eQuinelle pumps. This junction node was not included in Figure 7.

Under average day demand for future conditions, Figure 7 above shows that 0.2% of junctions have pressures at or below 350 kPa in the Mid Term and Long Term. However, this consists of only one (1) junction node (Junction J209) which is located at a relatively high elevation on the dead-end watermain on Hilltop Crescent. This junction node was found to have a pressure of 350 kPa in the Mid Term and 331 kPa in the Long Term. Therefore, all of the junction nodes exceed the minimum pressure of 276 kPa (40 psi) as recommended in the MECP Guidelines.

For the future conditions, the majority of junction nodes have pressures between 350 kPa and 550 kPa. There are a percentage of junction nodes which have pressures greater than 550 kPa but less than 689 kPa. The expected pressures generally decrease as more future growth is added, but any discrepancies in this are attributed to the change in pump configuration as explained previously. As more pumping capacity was modelled to supply the growing demand, pressures throughout the system may show improvement as compared to an earlier term.

Peak Hour Demand

The peak hour demand conditions were simulated to assess the system pressures expected throughout the Municipality. The table below provides a summary of the system operating conditions used in the model for each scenario that was included in this assessment. The table summarizes the pump configurations, the status at PRV-6 which was used in the model to delineate the two (2) pressure zones (boundary between Kemptville zone and eQuinelle zone), and the status at FCV-4 which was modelled on the Northwest Quadrant Pumping Station discharge line.

Table 17: Operating Conditions under Peak Hour Demand

Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
Existing (EX)	<ul style="list-style-type: none"> Duty Pump 2 is ON at all Pump Stations eQuinelle PMP-2 is operating. 	Inactive	Active at 23.7 L/s
Short Term (ST)	<ul style="list-style-type: none"> Duty Pump 2 is ON at all Pump Stations East Quadrant high-capacity pump is operating. eQuinelle PMP-2 is operating 	Inactive	Active at 23.7 L/s

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Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
Mid Term (MT)	<ul style="list-style-type: none"> Duty Pump 2 is ON at all Pump Stations East Quadrant high-capacity pump is operating. eQuinelle PMP-2 is operating 	Closed	Active at 23.7 L/s
Long Term (LT)	<ul style="list-style-type: none"> Duty Pump 2 is ON at Van Buren and Kernahan High-capacity pumps are operating at Northwest Quadrant Fire, Alfred and East Quadrant eQuinelle PMP-2 is operating 	Closed	Active at 76.1 L/s
Build Out (BO)	<ul style="list-style-type: none"> All high-capacity pumps are operating. East Quadrant high-capacity duplicate pump is operating. eQuinelle PMP-2 is operating 	Closed	Active at 76.1 L/s

It is noted that the high-capacity pump at East Quadrant was required in the Short Term and Mid Term scenarios, and additional high-capacity pumps were required under the Long Term and Build Out scenarios. Furthermore, the existing high-capacity pumps throughout the system were unable to supply the total peak hour demand under the Build Out scenario. Therefore, a theoretical duplicate high-capacity pump was added in the model at East Quadrant. Details for the size and location of a new pump in the system will be further assessed in Phase 2 of the Master Plan.

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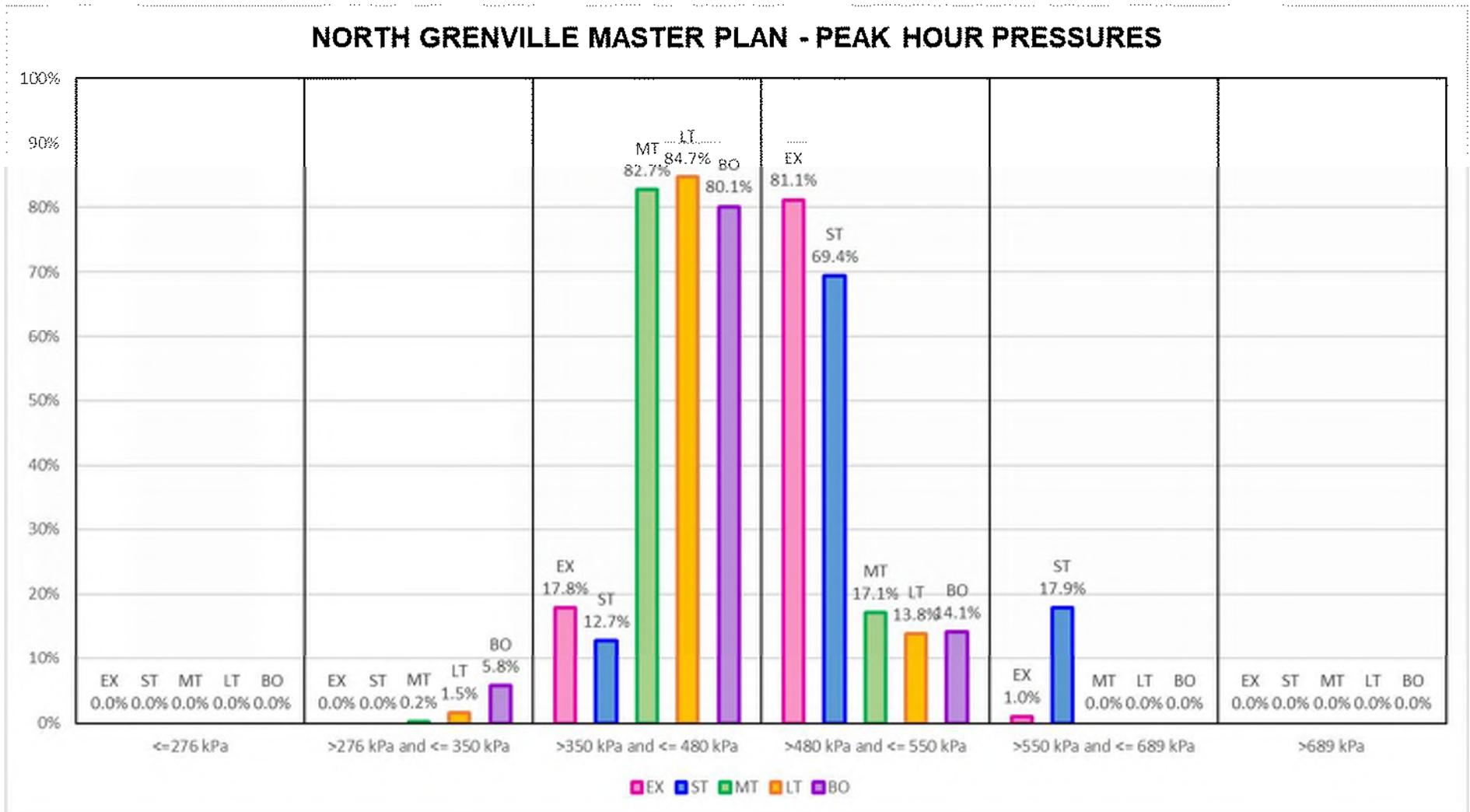


Figure 8: Pressures under Peak Hour Demand for Each Scenario

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Under peak hour demand for existing conditions, the simulation pressures were found to range from 413 kPa to 558 kPa. In the Kemptville pressure zone, the results generally fall within or slightly exceed the normal operating pressures of 350 kPa to 550 kPa, as per the Municipality's Engineering Standards. The maximum pressure expected in the Kemptville pressure zone is 558 kPa, which is less than the maximum pressure of 689 kPa (100 psi) as recommended by the MECP Guidelines but slightly exceeds 550 kPa as per the Municipality's Engineering Standards. In the eQuinelle pressure zone, the pump produces pressures that range from 458 kPa to 499 kPa, which remains below the maximum pressure of 550 kPa as per the Municipality's Engineering Standards. It should be noted that a pressure of 14 kPa was simulated at Junction J220, which represents the suction side of the eQuinelle pumps. This junction node was not included in Figure 8.

Under peak hour demand for future conditions, Figure 8 above shows that some junctions have pressures at or below 350 kPa under Mid Term, Long Term and Build Out, but all of the junction nodes exceed the minimum pressure of 276 kPa (40 psi) as recommended in the MECP Guidelines.

For the future conditions, the majority of junction nodes have pressures between 350 kPa and 550 kPa. There are a percentage of junction nodes in the Short Term which have pressures greater than 550 kPa but less than 689 kPa. The expected pressures generally decrease as more future growth is added, but any discrepancies in this are attributed to the change in pump configuration as explained previously. As more pumping capacity was modelled to supply the growing demand, pressures throughout the system may show improvement as compared to an earlier term.

Maximum Day Demand Plus Fire Flow

The maximum day demand plus fire flow conditions were simulated to assess the available fire flows expected throughout the Municipality. The maximum day demand plus fire flow condition was analyzed by allowing the model to calculate the maximum fire flow that can be drawn from each hydrant node (existing areas) or junction node (future areas) without allowing any part of the zone to experience pressures less than 140 kPa (20 psi). The table below provides a summary of the system operating conditions used in the model for each scenario that was included in this assessment. The table summarizes the pump configurations, the status at PRV-6 which was used in the model to delineate the two (2) pressure zones (boundary between Kemptville zone and eQuinelle zone), and the status at FCV-4 which was modelled on the Northwest Quadrant Pumping Station discharge line.

Table 18: Operating Conditions under Maximum Day Demand plus Fire Flow

Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
Existing (EX)	<ul style="list-style-type: none"> High-capacity pumps are operating at Alfred, Kernahan, East Quad eQuinelle PMP-5 is operating 	Inactive	Inactive

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Growth Scenario	Pumps	Pressure Reducing Valve (PRV-6)	Flow Control Valve (FCV-4)
Short Term (ST)	<ul style="list-style-type: none"> High-capacity pumps are operating at Alfred, Kernahan, East Quad eQuinelle PMP-5 is operating 	Inactive	Inactive
Mid Term (MT)	<ul style="list-style-type: none"> High-capacity pumps are operating at Alfred, Kernahan, East Quad, Northwest Quad eQuinelle PMP-5 is operating 	Closed	Active at 76.1 L/s
Long Term (LT)	<ul style="list-style-type: none"> High-capacity pumps are operating at Alfred, Kernahan, East Quad, Northwest Quad eQuinelle PMP-5 is operating 	Closed	Active at 76.1 L/s
Build Out (BO)	<ul style="list-style-type: none"> High-capacity pumps are operating at Alfred, Kernahan, East Quad, Northwest Quad eQuinelle PMP-5 is operating 	Closed	Active at 76.1 L/s

It is noted that the pump configurations for the maximum day demand plus fire flow scenarios were based on the high-capacity pumps required to satisfy the maximum day demand in the system.

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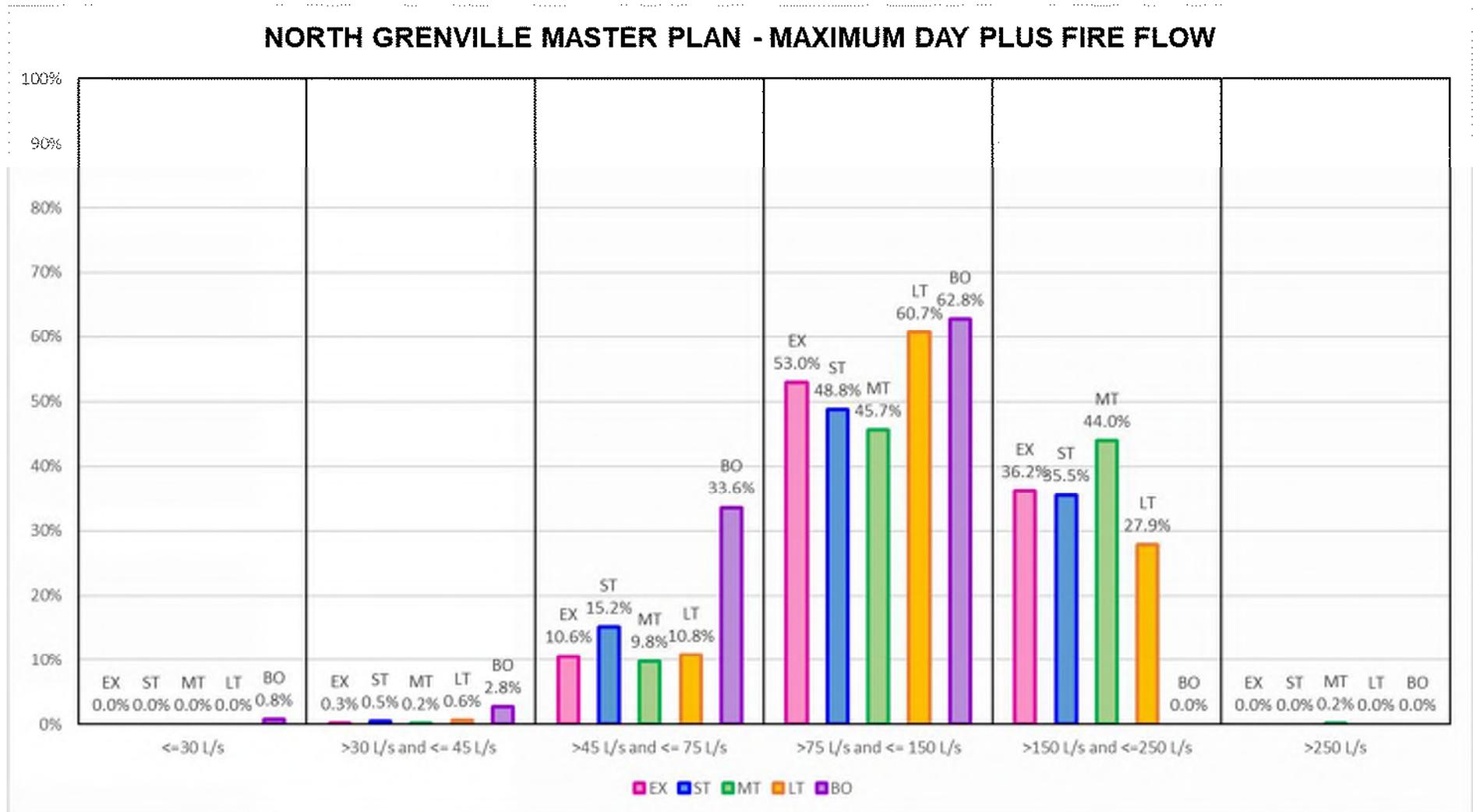


Figure 9: Available Fire Flows under Maximum Day Demand for Each Scenario

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Under maximum day demand plus fire flow for existing conditions, the majority of nodes are expected to deliver upwards of 75 L/s of fire flow. This exceeds both the 45 L/s minimum target per OBC and the 67 L/s target per FUS. There is a small percentage of nodes which are expected to deliver between 45-75 L/s of fire flow and are mostly located along smaller diameter dead-end pipes. There is one (1) hydrant (Hydrant H-1) which is expected to deliver less than 45 L/s of fire flow, located at the North Grenville District High School.

Under maximum day demand plus fire flow for future conditions, the majority of nodes are expected to deliver upwards of 75 L/s of fire flow. This exceeds both the 45 L/s minimum target per OBC and the 67 L/s target per FUS. There are some nodes which are expected to deliver less than 75 L/s of fire flow which are mostly located along dead-end pipes. Expected fire flows in the Build Out scenario are reduced the most due to the high demands.

4.10 Summary of Existing Conditions

The hydraulic water model was updated based on system expansions and upgrades that have occurred since 2020. Water demand scenarios were updated based on five (5) years of water consumption data, including updated water consumption data for the ten (10) highest water users in the system.

The modelling results for existing conditions indicate that adequate to high pressures are generally provided throughout the distribution system under the average day and peak hour demand scenarios. Under average day demand for existing conditions, the simulation pressures were found to range from 449 kPa to 625 kPa, which exceeds 550 kPa as per the Municipality's Engineering Standards. Under peak hour demand for existing conditions, the simulation pressures were found to range from 413 kPa to 558 kPa, which slightly exceeds 550 kPa. All pressures were found to be less than the maximum pressure of 689 kPa (100 psi) as recommended by the MECP Guidelines.

It is noted that under existing conditions, only Northwest Quadrant Duty Pump 1 supplied the Kemptville zone when the model was run. It is recommended the Municipality confirms this operation based on current system data.

The maximum day demand plus fire flow scenario for existing conditions indicates that most of the existing system can deliver a fire flow of 67 L/s. Based on a review of the FUS suggested fire flow requirements, 67 L/s satisfies the fire flow requirement for much of the existing system. The model schematic results are included in Appendix B.

4.11 Summary of Future Conditions

The future growth areas were modelled based on the development areas and population increases presented in the *Existing and Future Population, Employment, and Land Use Implications and Analysis Report* (JLR, March 13, 2025). These areas were modelled using representative loops and demands over the short-term (0-5 years) from 2026 to 2031, mid-term (5-10 years) from 2031 to 2036, long-term (10-20 years) from 2036 to 2046, and build-out (20+ years) from 2046 onward. Connections were made to the existing system only where necessary to illustrate the capacity of the current system to support development and determine the need for upgrades and additional watermains.

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The modelling results showed that with the future growth added to the system over time, the total pump supply capacity is inadequate without modifying the pump operation. In order to assess this in the model, the pump configurations (i.e. which pumps were operating) were adjusted based on the total capacity required for each individual scenario. If a specific configuration caused the model to be unbalanced, then a different configuration was attempted. The general approach was to use a configuration of the existing pumps throughout the system before proposing a new pump to provide additional pumping capacity. The peak hour build-out scenario was the only scenario that required a new proposed pump. For this scenario, a new theoretical pump was modelled at East Quadrant Pumping Station, which was assumed to be a second high-capacity pump with the same pump curve as the existing high-capacity pump at East Quadrant Pumping Station. There may be other feasible configuration options to those presented in the previous Section. The pump configurations and capacities will be further refined and assessed in Phase 2 of the Master Plan.

Using the assumed pump configurations for each future scenario as identified in the previous section, most of the distribution system was expected to experience pressures between 350 and 550 kPa. A very small percentage of junction nodes were expected to experience pressures below 350 kPa as per the Municipality's Engineering Standards. Some pressures higher than 550 kPa were experienced under the average day scenario and less in the peak hour scenario. This is due to the selected pump configurations which will be further assessed and refined in Phase 2 of the Master Plan.

The maximum day demand plus fire flow scenarios for future conditions indicates that most of the system can deliver a fire flow of 67 L/s. There are some nodes which are expected to deliver less than 75 L/s of fire flow which are mostly located along dead-end pipes. Expected fire flows in the Build Out scenario are reduced the most due to the high demands.

The model schematic results are included in Appendix B.

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5.0 Wastewater Collection System

5.1 Existing Wastewater System

The community of Kemptville is serviced by the Kemptville Water Pollution Control Plant (WPCP), located at 2899 County Road 43, adjacent to Kemptville Creek. The WPCP currently consists of a conventional activated sludge tertiary treatment process, with a rated average and maximum day capacity of 4,510 m³/d and 11,370 m³/d, respectively. The WPCP is undergoing expansion and upgrades to increase the rated average and maximum day capacity to 5,250 m³/d and 15,000 m³/d respectively. The upgrades have been split into two phases. Construction of Phase A commenced in 2024 and is expected to be completed in 2026. Phase B will start after the completion of Phase A, and is expected to be completed in 2028.

Parameter	Current WPCP ECA Rated Capacity	Upgraded WPCP ECA Rated Capacity
Average Day Flow (m ³ /d)	4,510	5,250
Maximum Day Flow (m ³ /d)	11,370	15,000 ⁽¹⁾
Peak Instantaneous Flow (m ³ /d) (L/s)	-	32,005 ⁽¹⁾ 370
Notes: (1) Peak flows above the maximum day flow are to be attenuated by influent equalization storage to 15,000 m ³ /d.		

There are no gravity sewers to the WPCP. All influent flow is pumped via forcemains from four (4) sanitary pumping stations. The rated capacities are summarized in the following table:

Table 19: Sanitary Pumping Station Rated Capacities

Sanitary Pumping Station	Rated Capacity (m ³ /d)
Bridge Street SPS	8,640 (existing) 11,370 (future) ⁽¹⁾
eQuinelle SPS	6,160
Tempo SPS	6,912
Colonnade SPS	6,990
Total	28,702 (existing) 31,432 (future)⁽¹⁾
Notes: (1) Bridge St SPS is currently operating at a lower flow rate due to the existing rated capacity of the WPCP. The 2019 ESR Addendum noted that once WPCP upgrades are completed, the Bridge St SPS can re-rated to its full rated pump capacity.	

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5.2 Historic Wastewater Flows and Bypasses

The historical influent wastewater data from the WPCP from 2020 to 2023 was provided by the Municipality and is summarized below:

Table 20: Historical WPCP Influent Flow (2020 to 2023)

Year	Average Day Demand ⁽¹⁾ (m ³ /d)	Maximum Day Demand ⁽¹⁾ (m ³ /d)	Maximum Day Factor
2020	2,553	6,892	2.70
2021	2,410	5,628	2.33
2022	3,159	8,651	2.74
2023	3,339	15,952	4.78
Average	2,866		3.14
Notes: (1) Flow data from WPCP influent proportional flow meter.			

As seen in Table 20, the overall average day wastewater demand is 2,866 m³/d, and an overall maximum day factor of 3.14 times the average day demand. This maximum day demand is roughly 64% of the current rated capacity and 55% of the future rated capacity.

The historical effluent wastewater data from the WPCP from 2020 to 2023 was provided by the Municipality and is summarized below:

Table 21: Historical WPCP Effluent Flow (2020 to 2023)

Year	Average Day Demand ⁽¹⁾ (m ³ /d)	Maximum Day Demand ⁽¹⁾ (m ³ /d)	Maximum Day Factor
2020	2,191	5,585	2.55
2021	1,963	4,972	2.53
2022	2,316	6,268	2.71
2023	2,713	9,827	3.62
Average	2,296		2.85
Notes: (1) Flow data from WPCP effluent electronic mag meter.			

As seen in **Error! Reference source not found.**, the overall average day wastewater demand is 2,296 m³/d, and an overall maximum day factor of 2.85 times the average day demand. This maximum day demand is roughly 51% of the current rated capacity and 44% of the future rated capacity.

As seen in the tables above, the average and max day influent flows are consistently greater than effluent flows. One of the causes is that the tertiary filter backwash line enters the WPCP influent upstream of the influent flow meter which could increase flow readings. In addition, the effluent flow is measured by an electronic mag meter and is expected to be much more reliable and accurate than the flow from the proportional flow weir at the influent channel. Although some

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filtered water is used by the plant, it is expected that this would be minor compared to the backwash returned. Typical operation is only bypassing the tertiary treatment and therefore, actual influent flows should be much closer to effluent flows. Therefore, for this Master Plan the average day and max day wastewater demand will be taken from the WPCP effluent flow historical analysis. It should be noted that the influent flow monitoring will be revised during the expansion of the WPCP, which will result in more accurate readings.

Since all flows to the WPCP are pumped, the peak instantaneous flow is the sum of all pump stations operating simultaneously at their rated capacities. Adding the flows in Table 19, the current peak instantaneous flow is 28,702 m³/d, with a possible increase to 31,432 m³/d in the future when Bridge St SPS is re-rated.

The following table summarizes the number of days noted in the wastewater annual reports where influent flow exceeded either the rated capacity (4,510 m³/d) or peak flow capacity (11,370 m³/d) was exceeded.

Table 22: Days Exceeding WPCP Rated Capacities

Year	No. Days Exceeding WPCP Capacities
2019	50
2020	17
2021	12
2022	51
2023	55

The following table is a summary of bypass and spill events at the WPCP noted in the Wastewater Annual Reports from 2019-2023. The majority of incidents were Tertiary Filter bypasses during the spring and summer months, caused by heavy precipitation and snowmelt.

Table 23: Kemptville WPCP Bypass and Spill Events 2019-2023

Incident Start Date	Incident Type	Volume (m ³)	Reason for Incident
February 24, 2019	Tertiary Filter Bypass	2.3	Heavy precipitation and snowmelt
March 22, 2019	Tertiary Filter Bypass	38.2	Snowmelt
March 25, 2019	Tertiary Filter Bypass	0.3	Emergency maintenance
March 29, 2019	Tertiary Filter Bypass	3,651.3	Heavy precipitation and snowmelt
April 20, 2019	Tertiary Filter Bypass	2,041.3	Heavy Precipitation
October 31, 2019	Tertiary Filter Bypass	5.4	Heavy Precipitation
January 11, 2020	Tertiary Filter Bypass	1,574.9	Heavy Precipitation
April 20, 2020	Methane Spill	335	Equipment Failure
August 11, 2020	Planned Methane Spill	35	Equipment Replacement
August 23, 2020	Tertiary Filter Bypass	259.4	Heavy Precipitation
October 5, 2021	Planned Methane Spill	35.2	Equipment Replacement
May 16, 2022	Tertiary Filter Bypass	9.4	Heavy Precipitation

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Incident Start Date	Incident Type	Volume (m ³)	Reason for Incident
January 6, 2023	Tertiary Filter Bypass	39.1	Heavy precipitation and snowmelt
February 21, 2023	Tertiary Filter Bypass	3,768.8	Equipment Maintenance
March 23, 2023	Tertiary Filter Bypass	241.5	Heavy precipitation and snowmelt
March 26, 2023	Tertiary Filter Bypass	1,067.2	Heavy precipitation and snowmelt
April 1, 2023	Tertiary Filter Bypass	2,215.9	Heavy precipitation and snowmelt
April 5, 2023	Tertiary Filter Bypass	16,075.7	Heavy precipitation and snowmelt
April 7, 2023	Tertiary Filter Bypass	10,988	Heavy precipitation and snowmelt
April 8, 2023	Tertiary Filter Bypass	17.8	Heavy precipitation and snowmelt
April 10, 2023	Tertiary Filter Bypass	475.8	Heavy precipitation and snowmelt
April 11, 2023	Tertiary Filter Bypass	712.2	Heavy Precipitation
April 30, 2023	Tertiary Filter Bypass	1,871.8	Heavy Precipitation
May 3, 2023	Tertiary Filter Bypass	1,649.6	Heavy Precipitation
August 7, 2023	Tertiary Filter Bypass	400.8	Heavy Precipitation

5.3 Wastewater System Design Criteria

Table 24 summarizes the wastewater demand rates used to evaluate the Municipality's wastewater system.

Table 24: Design Criteria - Wastewater Demand Rates

Land Use	Design Criteria	Maximum Day Factor
Future Residential ⁽¹⁾	300 L/cap/day	2.85
Future Commercial ⁽²⁾	28,000 L/ha/day	1.5
Future Industrial ⁽³⁾	35,000 L/ha/day	1.5
Future School ⁽⁴⁾	70 L/student/day	1.5
Future Hotel ⁽⁴⁾	225 L/bed/day	1.5
Future Retirement Home ⁽⁵⁾	300 L/bed/day	1.5
Notes		
(1) Municipality of North Grenville Engineering Standards E1.03.		
(2) MECP Design Guidelines for Sewage Works 5.5.2.2		
(3) MECP Drinking Water Design Guidelines 3.4.4		
(4) MECP Design Guidelines for Sewage Works Table 5-3		
(5) Assumed residential ADD		

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5.4 Future Wastewater System Requirements

The following table summarizes the existing and future wastewater demands:

Table 25: Existing and Future Wastewater Demands

Demand Scenario	Existing Conditions (2025) ⁽³⁾	Short-Term	Mid-Term	Long-Term	Build-Out
		(2026-2031)	(2031-2036)	(2036-2046)	(beyond 2046)
Population Growth	0	1,452	2,620	10,415	12,363
Total Serviced Population ⁽¹⁾⁽²⁾	7,386	8,838	11,458	21,873	34,236
ICI - Commercial Development Area (ha)		4.0	39.1	17.9	22.5
ICI - Retirement Home (No. Beds)		-	-	192.0	-
ICI - School (No. Students)		417			
ICI - Hotel (No. Beds)		-	74.0	-	-
ICI - Industrial Development Area (ha)		-	-	-	11.8
ICI - Correctional Facility					
Average Day (m ³ /day)		250	-	-	-
Max Day (m ³ /day)		995	-	-	-
Average Day (m ³ /day) - Residential		436	786	3,125	3,709
Average Day (m ³ /day) - ICI		391	1,111	558	1,043
Average Day (m³/day) - Total	2,296	3,123	5,020	8,703	13,455
Max Day (m ³ /day) - Residential		1,241	2,240	8,905	10,570
Max Day (m ³ /day) - ICI		1,207	1,667	838	1,565
Maximum Day Total (m³/day)	6,543	10,106	17,181	28,515	43,623
Notes:					
(1) The total serviced population represents residential population only and excludes equivalent institutional households and populations.					
(2) Total population excludes correctional facility population (528 persons) as demands are identified separate from residential flows.					
(3) Population of 6000 as of 2021 with addition of recently built developments.					

Figure 10 represents the projected average day wastewater flows and anticipated timing to reach 80% and 100% of the rated capacity of the WPCP. 80% rated capacity will be reached in 2033, and 100% rated capacity will be reached in 2036.

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It should be noted that the population projections from the 2019 ESR Addendum noted WPCP capacity will be reached in 2039. Due to an increased rate of planned development, the WPCP is expected to reach capacity sooner than anticipated, in 2036. It is recommended for the Municipality to conduct an annual review of uncommitted reserve capacity for future planning of developments.

In addition, the estimations of ICI wastewater flows are generalized and conservative. Depending on the application, the actual flows generated may be less than estimated, opening up WPCP capacity for other developments. It is recommended for the Municipality to review ICI applications to confirm expected flows and their demand for WPCP capacity.

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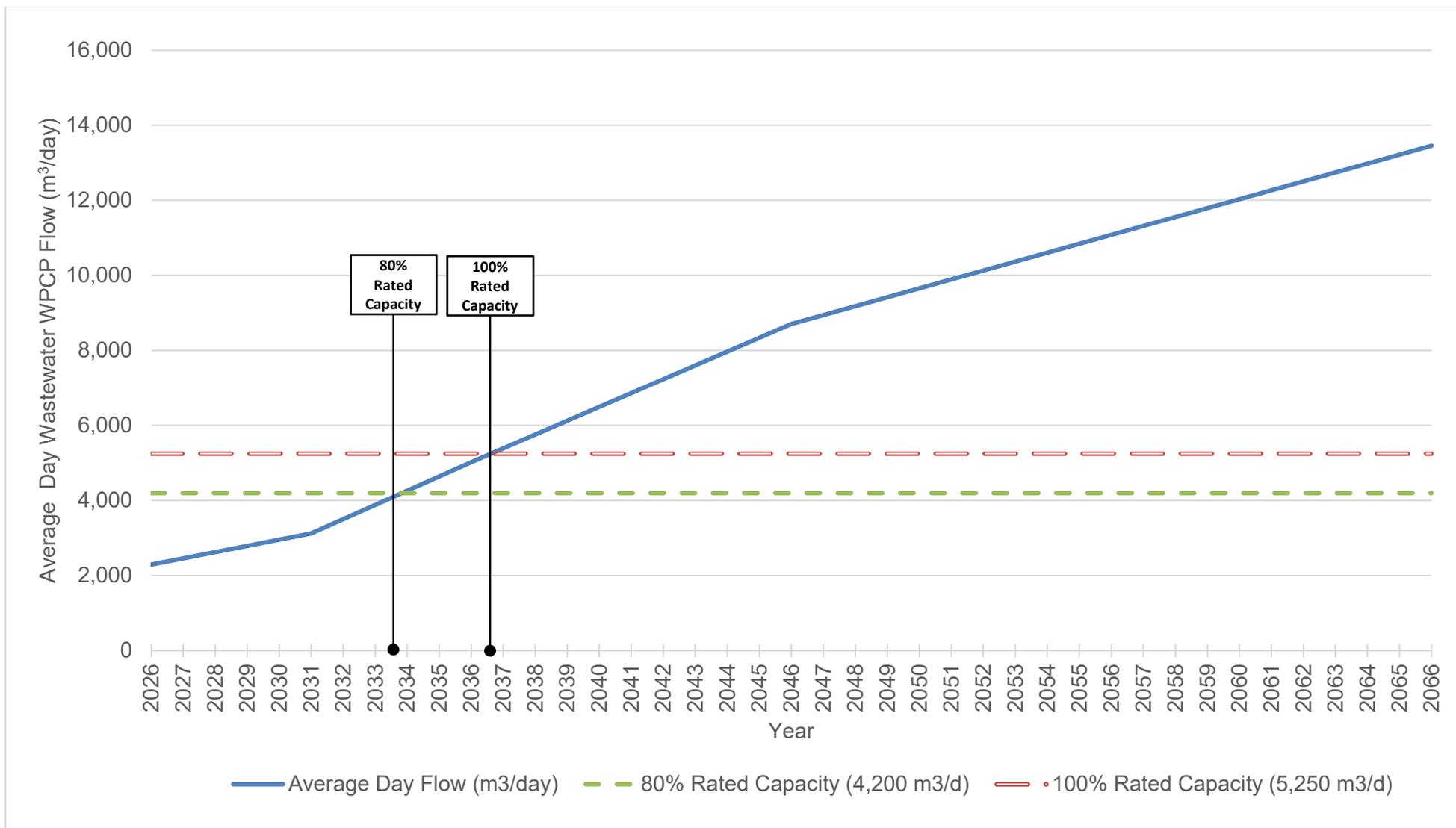


Figure 10: Projected Average Day Wastewater Flows