MUNICIPALITY OF THE COUNTY OF KINGS

Preliminary Cost Estimate

Village of Kingston Potable Water System

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1.0 Introduction

The Village of Kingston requested the assistance from the Municipality of the County of Kings in estimating the potential cost to construct a potable water system to supply the Village. The Village, located on the western edge of Kings County, is classified as a growth centre and had a population of 3023 people in 2006 (Municipality of County of Kings, 2010). Currently, residents are supplied through individual private wells. Based on the discussions between Village and Municipal staff, the Municipality's Engineering and Public Works section has prepared this report that explores three potential scenarios for developing a central water system for the Village.

2.0 Disclaimer

This report was prepared based on a preliminary review of potential designs for a central water system. The information presented in this report is a "desktop" technical assessment of potential system designs using available road and infrastructure maps, the Municipal Specifications manual, and available tender data from similar projects performed by the Municipality. No detailed design drawings, field investigations or calculations were performed during the preparation of this report. As such, this report should only be regarded as an initial pre-design report to advise the Village on potential design and capital cost scenarios. A qualified consultant should be retained to perform a more detailed technical and cost analysis prior to the Village committing significant resources to the project.

3.0 First Scenario

This scenario is based on connecting to the Greenwood Water Utility and assumes that the system is adequate to accommodate the Kingston population. Thus, it's assumed that no significant upgrades to the existing water source or water treatment systems are required. The layout is shown in Fig. 3.

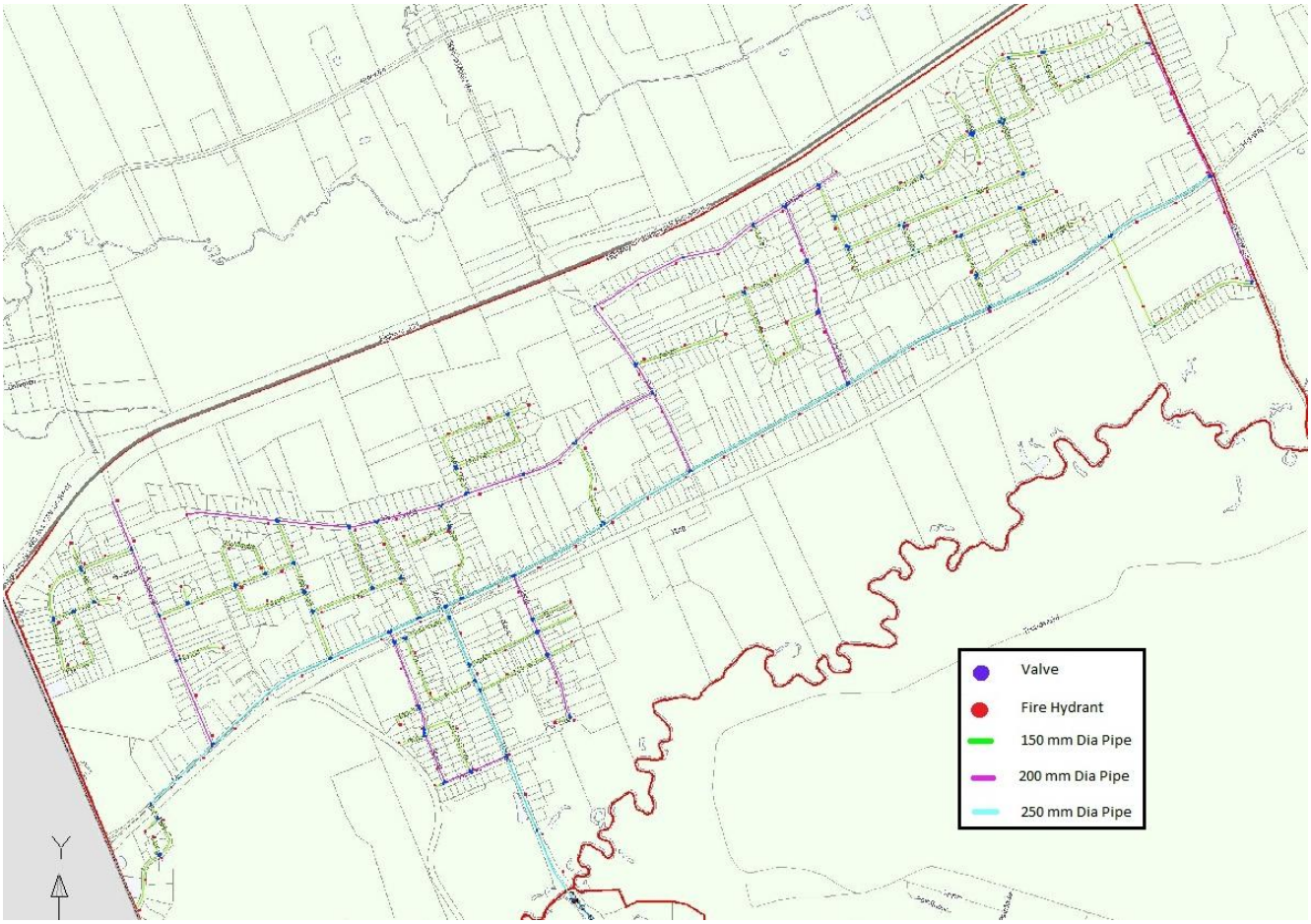

Figure 1. Assumed Pipe Configuration for Kingston, Nova Scotia. (Drawn by Nicole Ogilvie, 2011).

The approximate lengths of pipe are based on the linear road lengths. The total length of pipe needed is estimated to be 30,155 meters or about 30.2 kilometers.

The number and location of the fire hydrants and control valves were based on the requirements in the Municipality's "Municipal Specifications" manual. Hydrants were placed at maximum 150 meter spacing between hydrants, and placed at the end of all cul-de-sacs and dead end roads. Valves were placed on each leg of an intersection and every 400 meters between intersections. Table 1 shows the projected cost estimate for this scenario. A drawing of the conceptual distribution system layout is included in Appendix C. The number of service connections was determined using residential and commercial unit information provided by the Village of Kingston.

Table 1. Cost Estimate for Scenario One

Summary					
Item	**Description**	**Estimate**	**Unit**	**Unit Price**	**Total**
1	**Watermain, Fittings, Installation, Environmental**				
	.1 150 mm PVC Pipe	17015	m	$275.00	**$4,679,195.97**
	.2 200 mm PVC Pipe	7418	m	$300.00	**$2,225,434.75**
	.3 250 mm PVC Pipe	5721	m	$325.00	**$1,859,375.00**
2	**Fire Hydrants**	194	Ea	$6,075.00	**$1,178,550.00**
3	**Valves**				
	.1 150 mm Gate Valve	144	Ea	$1,650.00	**$885,600.00**
	.2 200 mm Gate Valve	67	Ea	$2,250.00	**$150,750.00**
	.3 250 mm Gate Valve	39	Ea	$2,825.00	**$110,175.00**
6	**Service Fittings and Copper Pipe**	1330	Ea	$1,000.00	**$1,330,000.00**
7	**Booster Stations***	2	Ea	$200,000.00	**$400,000.00**
8	**PRV ***	2	Ea	$122,325.00	**$244,650.00**
9	**Air Release Chambers***	5	Ea	$7,500.00	**$37,500.00**
10	**Road Reinstatement**				
	.1 Type I Gravel	15077	m3	$13	**$196,004.43**
	.2 Type II Gravel	19600	m3	$12	**$235,205.32**
	.3 Asphalt	15077	tonnes	$125	**$1,884,657.99**
11	**River Crossing With Bridge**	2	Ea	$100,000	**$200,000.00**
12	**Connection to Existing System**	1	Ea	$5,000.00	**$5,000.00**
				Subtotal	**$15,622,098.46**
	***Estimate Assumed**			**25% Engineering and Contingency**	**$3,905,524.61**
				Total	**$19,527,623.07**

Therefore, based on the assumptions stated above, the preliminary estimate for Scenario One was **$19,527,623.07**. For the potable water infrastructure in Kingston, not including the river crossings and connection to the existing system, the estimated cost is **$18,461,373.07.**

4.0 Second Scenario

This scenario is based on the assumption that Greenwood Water Utility's supply is adequate but a new transmission main is required to meet demand. Thus, this scenario includes cost estimates for two potential routes for a transmission main from the Greenwood water towers to Kingston.

4.1 Route A

As shown in Figure 2, Route A assumes a western route along Tremont Mountain Road, through Planes View Subdivision to the railway right-of-way to Main Street in Kingston. The cost estimate for Route A is shown in Table 2.

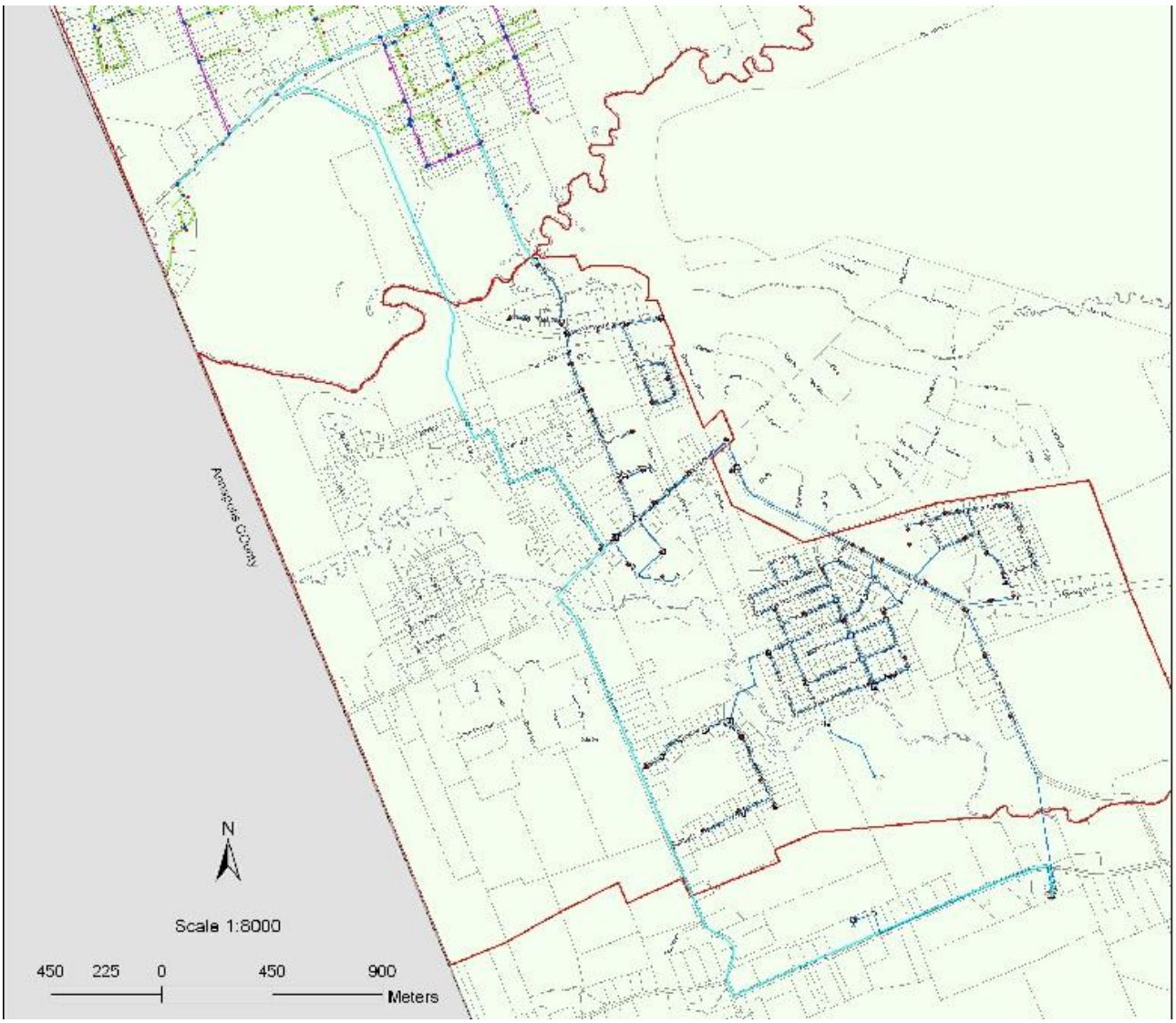

Figure 2. Route 2 – A, through Greenwood, Nova Scotia. (Drawn by Nicole Ogilvie, 2011)

This route is based on the assumption that the water main could be run underneath the transmission main from William Street to Kingston and following the railroad right-of-way to Main Street. This route will also require the acquisition of an easement which is not included in the cost estimate.

Table 2. Scenario 2-A. Cost Estimate for Second Transmission Line

Summary					
Item	**Description**	**Estimate**	**Unit**	**Unit Price**	**Total**
1	**Watermain, Fittings, Installation, Environmental**				
	.3 250 mm PVC Pipe	6451	m	$325.00	**$2,096,575.00**
2	**Valves**				
	.3 250 mm Gate Valve	17	Ea	$2,825.00	**$48,025.00**
3	**Connection to Existing System**	1	Ea	$5,000.00	**$5,000.00**
4	**Road Reinstatement**				
	.1 Type I Gravel	2344	m^3	$13	**$30,472.00**
	.2 Type II Gravel	3047	m^3	$12	**$36,566.40**
	.3 Asphalt	2344	tonnes	$125	**$293,000.00**
5	**River Crossing**				
	.1 River Crossing Without Bridge	1	Ea	$270,000	**$270,000.00**
	.2 River Crossing with Bridge	3	Ea	$100,000	**$300,000.00**
				Subtotal	**$3,079,638.40**
				25% Engineering and Contingency	**$769,909.60**
				Total	**$3,849,548.00**

4.2 Route B

As shown in Figure 3, Route B assumes an eastern route around the east side of 14 Wing Greenwood along Highway 201 and Highway 1, connecting to Main Street in Kingston at Greenwood Road. Although the physical distance is double that of Route A, the entire main can be located within publically owned land. Thus, Route B does not have the potential land acquisition issues as Route A. The cost estimate for Route B is shown in Table 3.

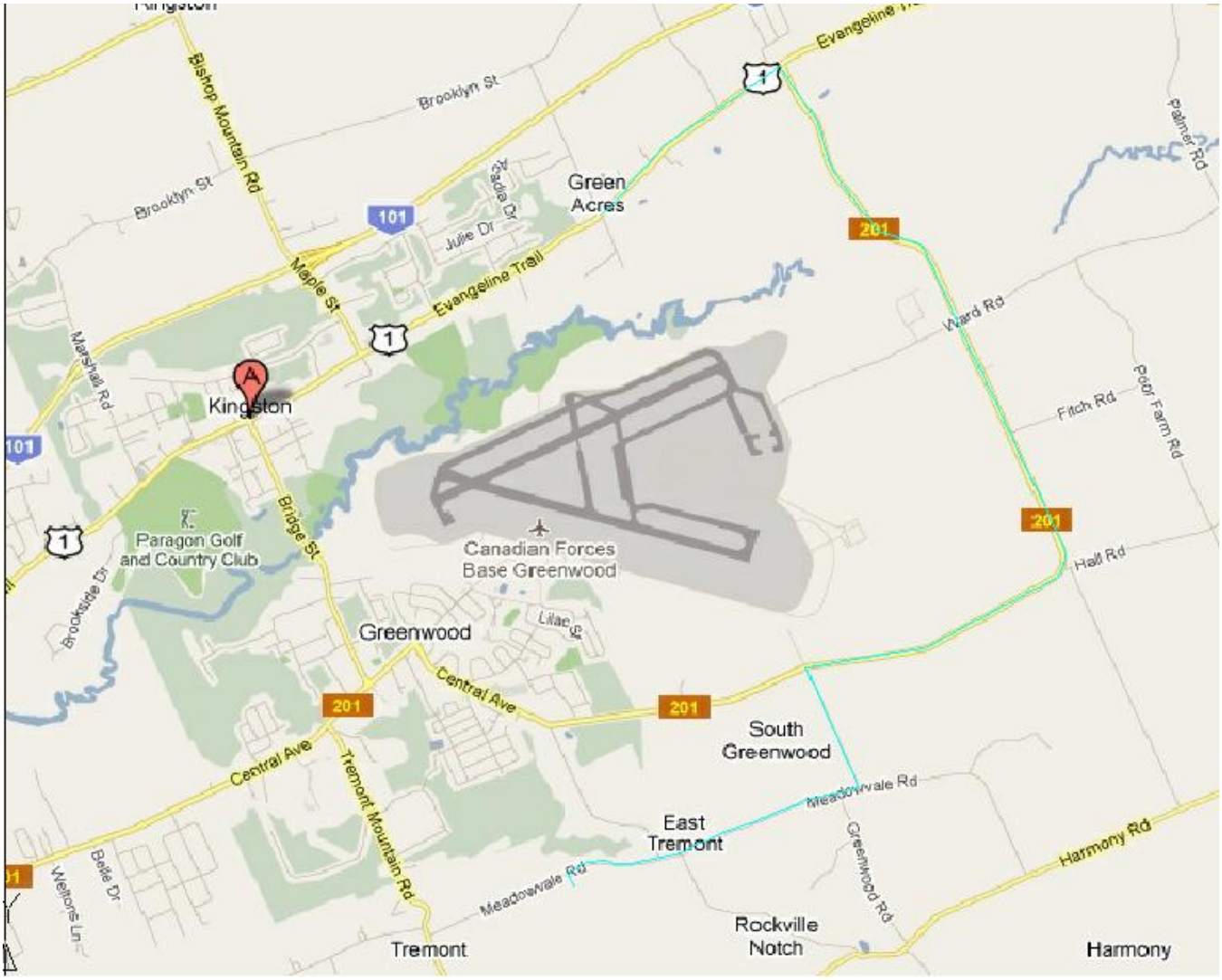

Figure 3. Scenario 2 Route B. (Image from Google Maps, 2011).

Table 3. Scenario 2-b: Cost Estimate for Secondary Line.

Summary					
Item	**Description**	**Estimate**	**Unit**	**Unit Price**	**Total**
1	**Watermain, Fittings, Installation, Environmental**				
	.3 250 mm PVC Pipe	12252	m	$325.00	**$3,981,778.70**
2	**Valves**				
	.3 250 mm Gate Valve	31	Ea	$2,825.00	**$87,575.00**
3	**Connection to Existing System**	1	Ea	$5,000.00	**$5,000.00**
4	**Road Reinstatement**				
	.1 Type I Gravel	6086	m^3	$13	**$79,112.44**
	.2 Type II Gravel	7911	m^3	$12	**$94,934.93**
	.3 Asphalt	6086	tonnes	$125	**$760,696.55**
5	**River Crossing With Bridge**	3	Ea	$100,000	**$300,000.00**
				Subtotal	**$5,309,097.62**
				25% Engineering and Contingency	**$1,327,274.40**
				Total	**$6,636,372.02**

Table 4 below compares the cost of the two possible routes for the new transmission main.

Table 4. Summary of Scenario Two Costs

Option	Cost of Supply	Total Cost
Option A	$3,849,548.00	**$22,310,921.07**
Option B	$6,636,372.02	**$25,097,745.10**

5.0 Third Scenario

This scenario assumes that the Village of Kingston would construct its own wells, reservoirs, and treatment facility. The exact location of the wells and treatment systems would have to be determined by a consultant after in-depth design. For this option, the pipe infrastructure in Kingston would be somewhat different in sizing given the location of the water source. However, as it follows the street layout, it would be comparable to the pipe layout assumed for the other scenarios thus the same cost will be used. This option does not require river crossings and long transmission mains like the other scenarios. The Village would be responsible for the maintenance and operation of its own reservoirs and treatment facilities in addition to the distribution system. Table 5 shows the cost breakdown for this scenario.

Table 5. Scenario Three

Summary					
Item	**Description**	**Estimate**	**Unit**	**Unit Price**	**Total**
1	**Storage Reservoir**	2	Ea	$1,000,000	**$2,000,000.00**
2	**Treatment Facilities**	1	Ea	$500,000.00	**$500,000.00**
3	**Purchase Land**	3	Lots	$49,900.00	**$149,700.00**
4	**Clearing and Grubbing**	32981	m2	$3.13	**$103,229.21**
5	**Well Preparation**	3	Ea	$100,000.00	**$300,000.00**
6	**Access Road**	100	m	$25.00	**$2,500.00**
7	**GUDI Studies**	1	LS	$100,000.00	**$100,000.00**
				Subtotal	**$3,155,429.21**
				25% Engineering and Contingency	**$788,857.30**
				Total	**$3,944,286.52**

With the infrastructure cost included, the total cost is **$22,405,659.59**

6.0 Summary

This report examined three possible options for providing central water to Kingston along with initial cost estimates for these scenarios. Table 6 compares the potential cost of each scenario.

Table 6. Summary of Supply Scenario Costs

Scenario	Cost
One ***- Provided Greenwood's system is adequate***	**$19,527,623.07**
Two A ***- Provided Greenwood's reservoirs and wells are adequate and land could be used***	**$22,310,921.07**
Two B ***– Provided Greenwood's reservoirs and wells are adequate***	**$25,097,745.10**
Three	**$22,405,659.59**

As shown in Table 6, Scenario One is the least expensive of the three scenarios. However, this scenario assumes that the Greenwood Water Utility infrastructure could accommodate the Kingston demand with minimal upgrades.

The most expensive is Scenario Two Route B. Route A is comparable in potential cost to Scenario Three. Again, this scenario assumes that the Greenwood Water Utility would only require minimal upgrades to service Kingston. Otherwise, some or potentially all of the well, reservoir and treatment system costs outlined in Scenario 3 may be applicable to both Scenario 2 options.

The second most expensive option is Scenario Three, based on the current projections for Scenarios One and Two. Scenario Three assumes that Kingston would establish its own water source consisting of wells, reservoirs and treatment facilities. This option removes the need for river crossings and long transmission mains. However, under this option the Village would be responsible for the maintenance and operation of the utility.

7.0 Recommendations

A qualified design consultant is required to assess the capacity of the Greenwood infrastructure, including the capacity of the wells and reservoirs to determine the feasibility of connecting to the Greenwood Water Utility. The consultant would also have to determine the current demand and fire flow requirements for the Village of Kingston and design a pipe system to accommodate those requirements. Surveys and a geotechnical investigation would also be needed. After in-depth design, more accurate estimates could be provided and the best option could be determined.

This estimate was based on a design without easements. Due to the prevalence of cul-de-sacs and dead end streets in the Village of Kingston, this is inefficient and would result in higher maintenance costs for flushing and chlorination. It would be preferable to loop the water mains wherever possible which would add costs for acquiring easements and additional infrastructure. However, these were not examined as this report was prepared to give a general understanding of the potential costs associated with the design and installation of a central water system.

8.0 References

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Quinn, Scott. (2010). *Overview of Municipal Services in Greenwood. Powerpoint Presentation to the Village of Greenwood Commission.*

Appendix A: Calculations

A.1: Distribution System

For "Item 1: Watermain, Fittings, Installation, Environmental", the pipe lengths were estimated from the linear lengths of streets in the municipal database. Sections which were not in the database were measured using the MPdb software. The following tables show this. It was also assumed that soil conditions in Kingston are comparable to North Kentville. Therefore the additional costs associated with rock excavation, unsuitable material excavation and replacement, erosion control, sediment control, trench relief drains, clay bulkheads and sampling stations were averaged over the length of a comparable project (i.e., Balsor Water Extension) and included in the unit costs. It was assumed that all pipes will be buried at least 1.5 meters below the existing ground surface.

Estimate for Pipe Length

Item 1.1 - 150 mm PVC Pipe

OBJECTID	SEGID	STATUS	STREET	ST_TYPE	Length in Meters	Assumed Diameter
3887	400013293	A	Paragon	Pl	64	150
4356	400022458	A	Mulligan	Pl	45	150
1869	183200002	I	Drummond	Dr	181	150
1870	183200003	I	Old French	Rd	120	150
1871	183200004	I	Acadia	Dr	273	150
1872	183200005	I	Old French	Rd	111	150
1873	183200006	I	Cartier	Crt	154	150
1874	183200007	I	Champlain	Crt	93	150
1875	183200012	I	Julie	Dr	35	150
1876	183200013	I	Acadia	Dr	190	150
1878	183200015	I	Shawn	Dr	125	150
1881	183200018	I	Old French	Rd	575	150
1882	183200019	I	Katelyn	St	124	150
1883	183200020	I	Julie	Dr	451	150
1885	183200023	I	Shawn	Dr	229	150
1886	183200024	I	Kingston Heights	Dr	177	150
1887	183200025	I	Hiltz	Dr	130	150
1888	183200026	I	Julie	Dr	209	150
1889	183200027	I	Katelyn	St	116	150
1890	183200028	I	Polaris	Crt	82	150
1891	183200029	I	Shawn	Dr	166	150

1892	183200030	I	Douglas	St	109	150
1894	183200033	I	Kingston Heights	Dr	229	150
1895	183200034	I	Kingswood	Lane	157	150
1896	183200036	I	Katelyn	St	108	150
1897	183200037	I	Shawn	Dr	207	150
1898	183200040	I	Philips	Ave	250	150
1899	183200041	N	Philips	Ave	74	150
1901	183200043	I	Kingswood	Lane	119	150
1905	183200047	I	Matthews	Lane	565	150
1906	183200048	A	Acker	Crt	321	150
1915	183200060	A	Wind Ridge	Rd	104	150
1918	183200068	I	Sparky	St	308	150
1921	183200071	I	Magee	Dr	81	150
1924	183200074	I	King	St	398	
1925	183200075	I	Bill	St	189	150
1926	183200079	I	Westwood	St	159	150
1929	183200083	I	Sunset	Dr	190	150
1930	183200084	A	Maplewood	Lane	74	150
1931	183200085	I	Lincoln	St	105	150
1932	183200086	I	Palmer	Dr	215	150
1933	183200087	I	Lincoln	St	112	150
1934	183200088	I	McMaster	Cres	364	150
1935	183200089	I	Elm	St	112	150
1936	183200090	I	Elizabeth	Ave	233	150
1938	183200093	I	Westwood	St	101	150
1941	183200098	I	Oakwood	Dr	61	150
1942	183200099	I	Maplewood	Lane	124	150
1944	183200101	I	Lincoln	St	180	150
1945	183200102	I	Lincoln	Crt	58	150
1946	183200103	I	Foster	St	304	150
1947	183200104	I	Westwood	St	79	150
1948	183200105	I	Elm	St	224	150
1950	183200107	I	Oakwood	Dr	80	150
1951	183200108	I	Palmer	Dr	151	150
1952	183200109	I	Elm	Lane	115	150
1954	183200111	I	Lincoln	St	105	150
1955	183200113	I	Oakwood	Dr	77	150
1956	183200114	A	Sunset	Dr	238	150
1957	183200115	I	Victoria	Dr	122	150

1959	183200117	I	Markland	Rd	167	150
1960	183200118	I	Markland	Rd	43	150
1961	183200119	A	Victoria	Dr	100	150
1962	183200120	I	Veterans	Lane	118	150
1963	183200121	I	Hillcrest	Ave	179	150
1965	183200123	I	Varner	St	60	150
1966	183200124	I	George	St	77	150
1968	183200126	I	Westwood	St	173	150
1969	183200127	A	Moody	Crt	159	150
1971	183200129	I	Victoria	Dr	167	150
1973	183200131	I	Cherry	Lane	181	150
1974	183200132	I	Sunset	Dr	187	150
1975	183200133	I	Princess	Lane	105	150
1977	183200135	I	Hillcrest	Ave	268	150
1979	183200137	I	Markland	Rd	376	150
1981	183200139	I	Mosher	St	85	150
1982	183200140	I	Parkside	Dr	81	150
1983	183200141	I	Belmont	St	83	150
1986	183200144	I	Prince	St	82	150
1989	183200147	I	Spring Garden	Rd	195	150
1991	183200149	I	Windsor	St	82	150
1996	183200162	N		Rd	117	150
1997	183200164	I	Warner	Dr	57	150
1998	183200165	I	George	St	165	150
1999	183200166	I	Pleasant	St	163	150
2004	183200172	N		Rd	65	150
2005	183200176	I	Wind Ridge	Rd	106	150
2006	183200182	I	Brookside	Dr	467	150
2009	183200190	I	Laurel	St	243	150
2010	183200191	I	Laurel	St	67	150
2011	183200197	I	Heather	Cres	344	150
2018	183200206	I	Magee	Dr	275	150
2020	183200208	I	Brookridge	Pl	76	150
2029	183200222	I	Acadia	Dr	120	150
2030	183200223	I	Acadia	Dr	242	150
2031	183200224	I	Cynthia	Dr	145	150
2034	183200227	I	Acorn	Lane	372	150
3852	400003361	A	Kalley	Lane	406	150
Connection of Kalley Lane to Main St to form loop (MPdb):					354	150

Markland Road (MPdb)					211	150

Item 1.1 150 mm PVC Pipe:	**17015**	**m**

Item 1.2 - 200 mm PVC Pipe

OBJECTID	SEGID	STATUS	STREET	ST_TYPE	Length in Meters	Assumed Diameter
1877	183200014	A	Balser	Dr	87	200
1879	183200016	A	Balser	Dr	138	200
1884	183200021	I	Balser	Dr	132	200
1893	183200031	I	Old Brook	Rd	208	200
1902	183200044	I	Old Brook	Rd	180	200
1903	183200045	I	Balser	Dr	632	200
1904	183200046	I	Maple	St	101	200
1907	183200049	I	Maple	St	245	200
1909	183200051	I	Old Brook	Rd	273	200
1910	183200052	I	Maple	St	117	200
1911	183200053	I	Pine Ridge	Ave	323	200
1913	183200056	I	Maple	St	298	200
1914	183200059	A	Pine Ridge	Ave	415	200
1916	183200063	A	Pine Ridge	Ave	104	200
1919	183200069	I	Pine Ridge	Ave	226	200
1920	183200070	A	Pine Ridge	Ave	311	200
1922	183200072	I	Pine Ridge	Ave	101	200
1923	183200073	I	Pine Ridge	Ave	247	200
1953	183200110	A	Park	Rd	166	200
1958	183200116	I	Park	Rd	42	200
1964	183200122	I	Park	Rd	94	200
1970	183200128	A	Marshall	Rd	168	200
1980	183200138	I	Bishop	Ave	245	200
1984	183200142	I	Bishop	Ave	76	200
1985	183200143	I	Bishop	Ave	20	200
1988	183200146	I	Windsor	St	137	200
1990	183200148	I	Bishop	Ave	186	200
1992	183200153	I	Windsor	St	155	200
2002	183200169	I	Marshall	Rd	135	200
2003	183200170	A	Marshall	Rd	183	200
2008	183200188	I	Maple	St	80	200

2017	183200204	I	Marshall	Rd	209	200
2019	183200207	I	Park	Rd	232	200
2021	183200209	I	Marshall	Rd	177	200
2022	183200210	I	Marshall	Rd	70	200
Greenwood Road Kalley Lane to Acorn Lane (MPdb)					904	200

Item 1.2 - 200 mm PVC Pipe	**7418**	**m**

Item 1.3 - 250 mm PVC Pipe

OBJECTID	SEGID	STATUS	STREET	ST_TYPE	Length in Meters	Assumed Diameter
1900	183200042	I	Main	St	906	250
1908	183200050	A	Main	St	556	250
1912	183200055	A	Main	St	623	250
1917	183200067	I	Main	St	360	250
1928	183200082	A	Main	St	354	250
1939	183200094	A	Main	St	196	250
1943	183200100	A	Main	St	20	250
1949	183200106	I	Bridge	St	40	250
1967	183200125	I	Main	St	346	250
1972	183200130	I	Bridge	St	180	250
1976	183200134	I	Bridge	St	59	250
1978	183200136	I	Bridge	St	34	250
1987	183200145	I	Bridge	St	249	250
1993	400012146	A	Main	St	218	250
1994	183200157	I	Bridge	St	505	250
2000	183200167	I	Main	St	102	250
2001	183200168	A	Main	St	407	250
2007	183200183	I	Main	St	300	250
2023	183200214	I	Main	St	66	250
2024	183200215	I	Bridge	St	62	250
2025	183200216	I	Main	St	48	250
2026	183200217	I	Main	St	26	250
2027	183200218	A	Main	St	40	250
2028	183200219	A	Main	St	25	250

Item 1.3 - 250 mm PVC Pipe:	**5721**	**m**

According to the 1997 Municipal Specifications, cul-de-sacs greater than 90 meters in length require a hydrant at the end for flushing. In addition, hydrant must be placed at a maximum of 150 meters apart, preferably in intersections and in the middle of long blocks. To be conservative, hydrants were placed at the end of every dead end street. Valves must be placed on each leg of an intersection and every 400 meters where there are no intersections. By plotting the hydrants and valves on AutoCad using these assumptions, the following estimates were obtained:

Fire Hydrant Spacing	m	150
# of Fire Hydrants	**Ea**	**194**
Valve Spacing	**m**	400
150 mm Gate Valve	**Ea**	**144**
200 mm Gate Valve	**Ea**	**67**
250 mm Gate Valve	**Ea**	**39**

As the municipality does not have a vertical profile of the Kingston Streets readily available, but the Village of Kingston is very flat, it was assumed that five Air Relief Valves, two PRVs and two Booster Stations were a fair estimate, based on the judgment of the engineering department.

For the number of Service Connections, the following table (provided by the village of Kingston) was used:

Description	Number of Connections/Type of unit	# of accounts	Connections
single dwelling	1	983	983
2 units (duplex)	2	53	106
3 units (triplex)	3	3	9
4 units (quad)	4	6	24
vacant lot	1	112	112
Basic Commercial Service (1-5 employees)	1	14	14
Basic Commercial Service (6-10 employees)	1	3	3
Basic Commercial Service (11-15 employees)	1	2	2
Basic Commercial Service (26-30 employees)	1	1	1
NS Liquor Commission	1	1	1
Aliant Telecom	1	1	1
Manufacturer	1	3	3
Manufacturer	1	2	2
Restaurant	1	1	1
Tea Room/Takeouts	1	1	1
Licensed Premises	1	1	1

old Foodland bdg	1	1	1
serv stn - washroom - 10 empl	1	3	3
garage - no washroom - 5 to 10 empl	1	1	1
Lions club	1	1	1
Markland Lodge	1	1	1
appt - 10 unit	1	2	2
appt - 12 unit	1	2	2
appt - 13 unit	1	1	1
appt - 6 unit	1	1	1
appt - 9 unit	1	2	2
appt - 11 unit	1	1	1
appt - 23 unit	1	1	1
appt - 8 unit	1	1	1
appt - 5 unit	1	2	2
appt - 16 unit	1	1	1
single dwelling + comm business	2	2	4
2 units + commercial business	2	2	4
3 units + 2 commercial businesses	3	1	3
3 units + commercial business	3	2	6
single unit + hairdresser	1	2	2
4 units + hairdresser	4	1	4
appt - 26 unit	1	1	1
single dwelling + comm business	1	2	2
restaurant + 2 commercial business	1	1	1
Grocery Store (Superstore) + Gas Bar	1	1	1
2 commercial units	2	2	4
2 dwelling + comm business + restaurant	2	1	2
4 unit + 2 commercial + pub	4	1	4
2 units + 2 commercial	2	1	2
3 units + 2 commercial	3	1	3
Legion	1	1	1
Restaurant + dwelling	1	1	1
		1231	**1330**
Item 5 - Service Connections:			**1330**

For road reinstatement, it was assumed that the width of one lane would be reinstated after installation and the following table was generated:

Item 7 - Road Repair

Total Length of Pipe: 30155 m

Item	Description	Depth	Cross-Sectional Area	Volume
		mm	m2	m3
7.1	Type I Gravel	150	0.5	15077
7.2	Type II Gravel	200	0.65	19600

Item	Description	Volume Per Metre	Volume
		Tonnes/m	Tonnes
7.3	Asphalt	0.5	15077

A.2: Scenario One

To connect to the Greenwood system as it is, there would be two river crossings and a connection. The cost of the river crossings was assumed to be $100,000 for attaching to the existing bridges rather than drilling under the rivers. The cost of connecting to the existing system was based on comparison of tenders.

A.3: Scenario Two

Scenario Two was estimated similarly to the distribution system and the numbers are outlined in Tables 2 and 3. The tender price for a river crossing without a bridge was obtained using the average bid from an old tender plus 25% inflation.

A.4: Scenario Three

This estimate was done conservatively as the municipality does not have tenders that are comparable from the past few years. In addition, without a design, it is difficult to determine the size of the reservoirs. The tender price for the storage reservoirs (water towers) was assumed by rounding up from the cost of the Canning water tower. The amount of land and clearing needed was calculated by measuring the size of the area of the water tower lot in Greenwood and comparing it to a currently listed lot in Kingston. From this it was determined that three lots would be needed for the towers and the treatment facilities. This does not included the well fields, as a consultant would have to determine the location of these and how much land is needed for each well. It was assumed that the cost of each well would be $100,000 and the cost of a GUDI study would also be $100,000.

Appendix B: 1997 Municipal Specifications, Section 4

Appendix C: Conceptual System Drawing