

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.

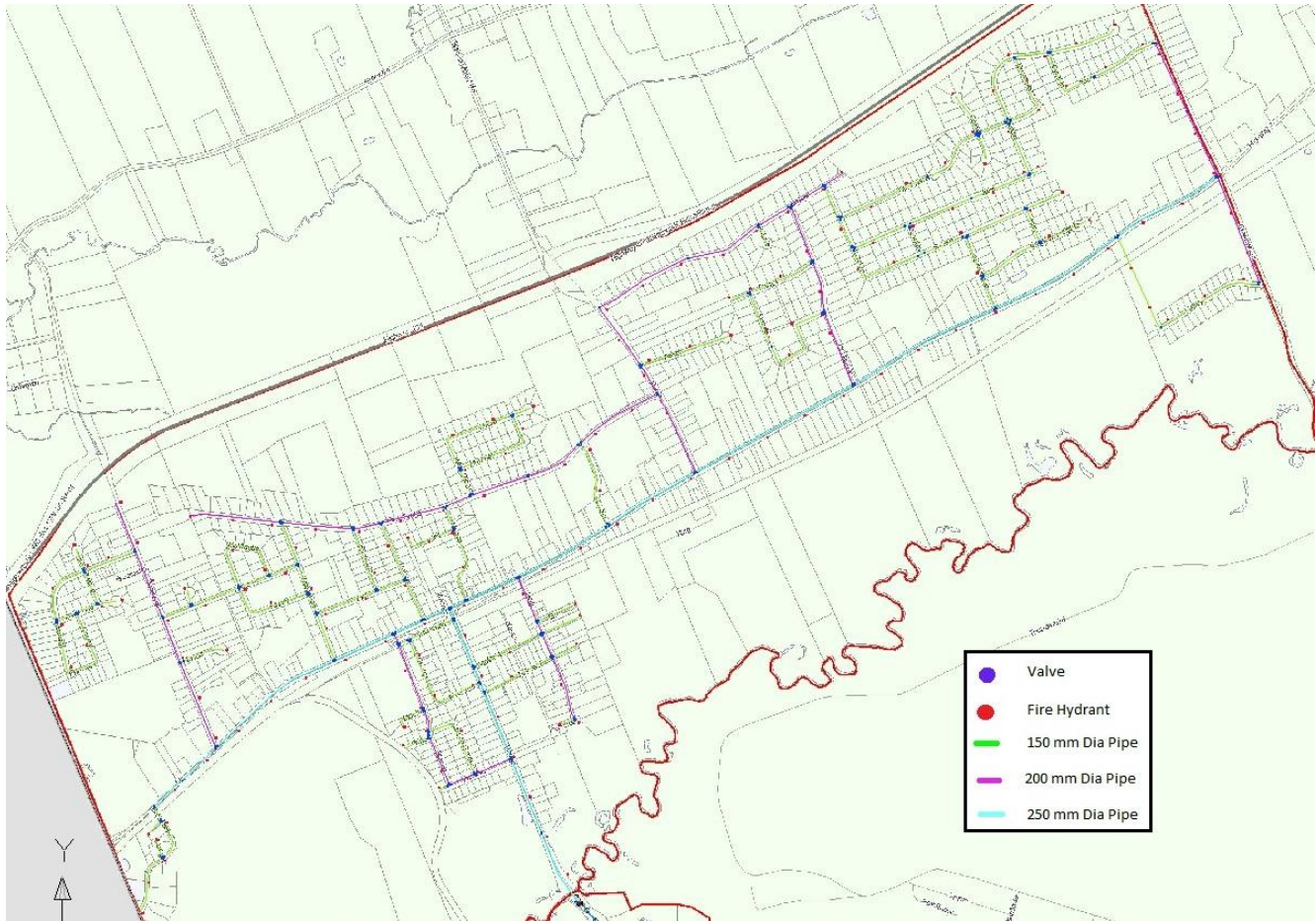


Figure 1. Assumed Pipe Configuration for Kingston, Nova Scotia. (Drawn by Nicole Ogilvie, 2011).

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 | | | | | |
| | <i>.1 150 mm PVC Pipe</i> | 17015 | m | \$275.00 | \$4,679,195.97 | |
| | <i>.2 200 mm PVC Pipe</i> | 7418 | m | \$300.00 | \$2,225,434.75 | |
| | <i>.3 250 mm PVC Pipe</i> | 5721 | m | \$325.00 | \$1,859,375.00 | |
| 2 | Fire Hydrants | 194 | Ea | \$6,075.00 | \$1,178,550.00 | |
| 3 | Valves | | | | | |
| | <i>.1 150 mm Gate Valve</i> | 144 | Ea | \$1,650.00 | \$885,600.00 | |
| | <i>.2 200 mm Gate Valve</i> | 67 | Ea | \$2,250.00 | \$150,750.00 | |
| | <i>.3 250 mm Gate Valve</i> | 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.

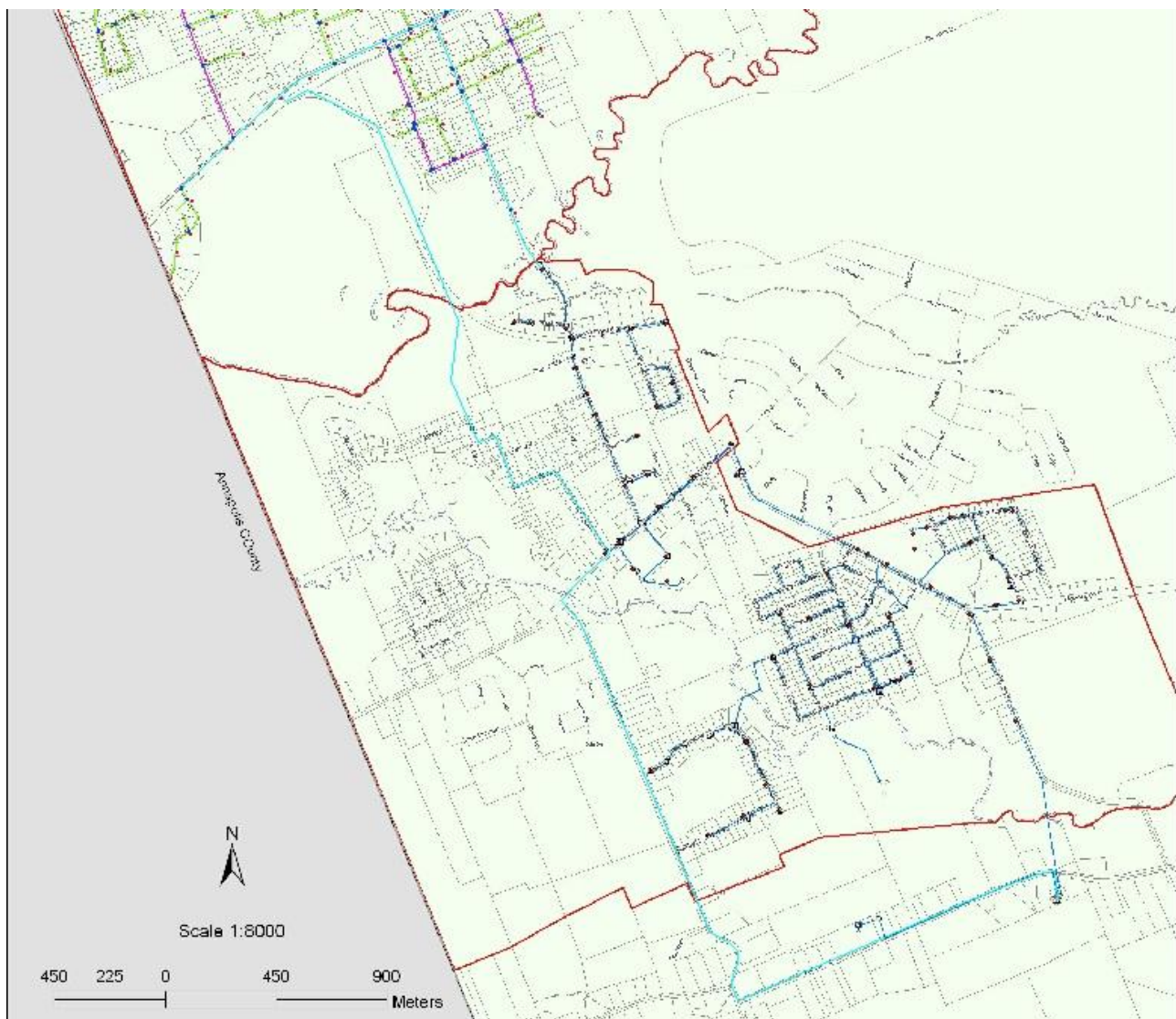


Figure 2. Route 2 – A, through Greenwood, Nova Scotia. (Drawn by Nicole Ogilvie, 2011)

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 | | | | | |
| | <i>.3 250 mm PVC Pipe</i> | 6451 | m | \$325.00 | \$2,096,575.00 | |
| 2 | Valves | | | | | |
| | <i>.3 250 mm Gate Valve</i> | 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.

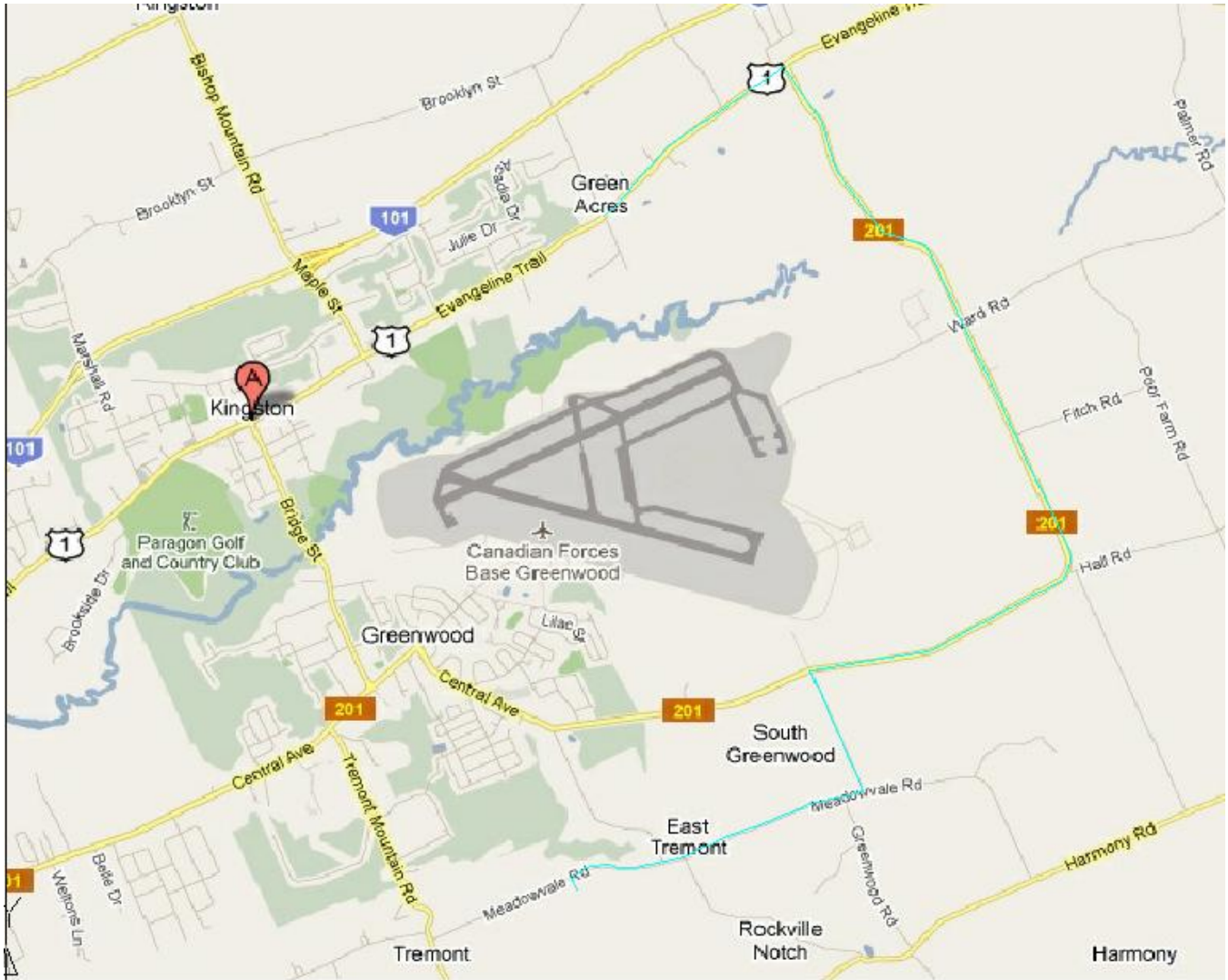


Figure 3. Scenario 2 Route B. (Image from Google Maps, 2011).

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

| Summary | | | | | | |
|---------|---|----------|----------------|------------|--|-----------------------|
| Item | Description | Estimate | Unit | Unit Price | Total | |
| 1 | Watermain, Fittings, Installation, Environmental | | | | | |
| | <i>.3 250 mm PVC Pipe</i> | 12252 | m | \$325.00 | \$3,981,778.70 | |
| 2 | Valves | | | | | |
| | <i>.3 250 mm Gate Valve</i> | 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 <i>- Provided Greenwood's system is adequate</i> | \$19,527,623.07 |
| Two A <i>- Provided Greenwood's reservoirs and wells are adequate and land could be used</i> | \$22,310,921.07 |
| Two B <i>- Provided Greenwood's reservoirs and wells are adequate</i> | \$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

County of Kings. (2004). *Greenwood Water Utility System Assessment Report*.

Municipality of County of Kings. (2007). *Balsor Water Extension*.

Municipality of County of Kings. (2010). *County Statistics - Population Data*. Retrieved May 11, 2011, from Municipality of County of Kings: <http://www.county.kings.ns.ca/information/population.htm>

Municipality of County of Kings. (2009). *Kingsport Central Water*.

Municipality of County of Kings. (1997). *Municipal Specifications*.

Municipality of County of Kings, MPdb Software (In-House). (2002).

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 Meters | in | 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 Meters | in 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 Meters | in | 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 |
| <i>Item 5 - Service Connections:</i> | | | 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 | m ² | m ³ |
| 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 include 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