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July 10, 2001

RVA: 5425

Mr. Allen Lucas, P.Eng.
Utilities Engineer
Utilities Kingston
211 Counter Street
P.O. Box 790
Kingston, ON K7L 4X7

Dear Mr. Lucas:

Re: Schedule B File Report, Great Cataraqui River Utilities Crossing Project

In July 2000, R.V. Anderson Associates Limited (RVA) in association with Josselyn Engineering Inc. were retained by Utilities Kingston to determine the best means for supplying water and wastewater services across the Great Cataraqui River between downtown Kingston and the urbanized communities of Pittsburgh¹. The study was completed in accordance with the provincially approved Municipal Engineers Association *Municipal Class Environmental Assessment*² process, and the *Canadian Environmental Assessment Act*, and carried out over a period of one year. The preferred solution identified as a result of the study is to twin the existing watermain and forcemain at the existing utility corridor that cross the river between River Street on the west shore and James Street on the east shore. Other related on-land works have been recommended to ensure the integrity of the system such as upgrades to the River Street Pumping Station (PS) and the James Street Water Booster Station (WBS). This Schedule 'B' file report summarizes the work carried out, the analyses undertaken, and the rationale for this recommendation. Supporting documentation is attached hereto, including the results of public consultation.

¹ Refer to Appendix 1, "Proposal for the Evaluation of Alternatives including Cost Estimates and the Environmental Assessment Process for a Sanitary Sewer, Water, and Other Utilities Crossing(s) of the Great Cataraqui River", Utilities Kingston, March 24, 2000.

² Refer to Appendix 2, "Municipal Class Environmental Assessment (Exhibit A.2)", Municipal Engineers Association, June, 2000.

1.0 BACKGROUND

In 1955, a watermain and sewage forcemain were installed under the Great Cataraqui River. The sewage forcemain conveys sewage generated by approximately 60,000 people living and working west of the river to the Ravensview Water Pollution Control Plant (WPCP) located east of the river. The watermain carries water from the Kingston Central Water Treatment Plant (WTP) west of the river to about 10,000 people living east of the river (see Figure 1). Since they were installed, both the watermain and the sewage forcemain have operated without problems. In 1997, divers conducted visual inspections and found no signs of pipe movement or leakage.

However, these pipes are now almost 50 years old and, if problems were to occur, there is no backup in place for either system. Furthermore, the River Street Pumping Station, which pumps sewage through the forcemain, has insufficient storage to handle flows during wet weather events. As a result, combined sewer overflows to the river occur during heavy rainfall when storage capacity is exceeded. (Combined sewers are sewers that collect sanitary sewage from buildings as well as rainwater and snowmelt from streets.) The purpose of this study was to determine how best to address the system reliability and environmental protection concerns of the existing Great Cataraqui River sewer and water crossings, not to review the City's CSO strategy.

2.0 PROJECT METHODOLOGY AND PUBLIC CONSULTATION

The consulting team was retained by Utilities Kingston in July 2000 and spent July and August collecting and reviewing background information and establishing contacts with concerned stakeholders. A project Steering Committee (SC) was established to direct the consultant team at key stages of the project, consisting of senior Utility staff and the project manager.

On August 10, 2000, a press release was issued and a public notice published notifying the public of the intent to complete the study and inviting people to participate on the Public Advisory Committee (PAC). A web site was established that provided background on the project, the proposed Terms of Reference for the Committee, an application form for members-at-large positions, the evaluation criteria for selecting members, answers to "Frequently Asked Questions", the press release, and photos of the study area.³ key information was also made available in hard copy at all municipal offices.

³ Refer to Appendix 3, Initial Public Contact.

The PAC was established in September and consisted of sixteen (16) people from groups representing various interests in the project, including four members-at-large from the community. Seventeen (17) applications were received for the four member-at-large positions. The project SC used the published evaluation criteria to identify the preferred candidates. The PAC met six times over the course of the project.⁴

A Technical Advisory Committee (TAC) was established that same month, consisting of representatives from the following organizations:

- Parks Canada
- National Defense
- Transport Canada
- Fisheries & Oceans (incl. Coast Guard)
- Public Works & Government Services
- Cataraqui River Conservation Authority
- Ministry of Environment
- Ministry of Natural Resources
- City of Kingston planning, engineering, and environmental divisions.

The purpose of the TAC was to ensure that concerned agencies and municipal partners were kept abreast of the project's progress, and able to provide timely input into the decision-making process. Five TAC meetings were held over the course of the study⁵. In addition to the TAC, two meetings were held with federal representatives to discuss matters of federal interest such as the federal Environmental Assessment process.⁶

In November 2000, Geo-Canada Inc. (a partner to RVA hired under separate contract), completed a drilling program in the Great Cataraqui River to determine the geotechnical conditions beneath the river and to assess contamination levels in the river sediment⁷. In preparation for that work a federal Environmental Screening Report was prepared by the consultant team and license granted by Transport Canada⁸ for in-river works.

Concurrent to preparation of the federal Environmental Screening Report for the drilling activity, the initial stages of work were completed on the provincial Environmental Assessment.

⁴ Refer to Appendix 4, PAC Membership and Meeting Notes.

⁵ Refer to Appendix 5, TAC Membership and Meeting Notes.

⁶ Refer to Appendix 6, Federal Input.

⁷ Refer to Annex A, "Volume 1 – Factual Data: Report on Geotechnical & Environmental Investigation for proposed sanitary sewer, water and other Utility Crossings of the Great Cataraqui River", Geo-Canada Ltd; May, 2001; and Annex B, "Volume 2 – Engineering Interpretation and Recommendations Report on Geotechnical & Environmental Investigation for proposed sanitary sewer, water and other Utility Crossings of the Great Cataraqui River", Geo-Canada Ltd; May, 2001.

⁸ Refer to Annex C, "Environmental Screening Report: City of Kingston Cataraqui River Subsurface Exploration". R.V. Anderson Associates Limited, October 2000. (Note, Transport Canada (TC) was understood to own the land on which the drilling was to take place and as such acted as Lead Responsible Authority for the federal screening. During this period,

Technical Memoranda were prepared on the existing water and wastewater systems as they pertained to the river crossing. The documents set out existing conditions, defined the problems to be addressed, provided a long-list of alternative solutions for addressing the problems, and outlined an approach for screening the options to arrive at a short-list to undergo detailed environmental evaluation⁹. The problem statements, long-list of alternatives, and the screening criteria were presented to the PAC and TAC for discussion and comment before being finalized.

On December 12, 2000, workshops were held with the PAC and TAC at which the screening criteria were applied to the long-list of alternatives. The consultant team reviewed draft Advisory Committee screening results with the Steering Committee prior to confirming the short-listed solutions. A Public Open House was held on February 15, 2001 to present and obtain feedback on the consultation screening short list of solutions. Twenty-seven people attended the event¹⁰. Comments received during this process were considered during finalization of the short-listed solutions¹¹, and subsequently in the establishment and weighting of detailed evaluation criteria.

Over the winter, a Stage 1 Archaeological Assessment¹² and a Natural Environment Existing Conditions Report were prepared to assist with the detailed evaluation of the short-listed alternatives¹³.

In March 2001, the consultants issued draft detailed evaluation criteria to be used in assessing alternative solutions. These were reviewed by the Public Advisory Committee, Technical Advisory Committee and Steering Committee. A notice was published in local papers on March 10, 2001 and the web site updated, inviting the general public to comment on the draft criteria¹⁴. The detailed evaluation approach, criteria and weighting were finalized upon consideration of all comments received.¹⁵

TC joined the TAC. There is now doubt whether TC owns the utility corridor and the matter is currently under investigation by both parties).

⁹ Refer to Annex D, "Technical Memorandum No. 1: Wastewater Problem Definition, Alternatives and Screening Approach." R.V. Anderson Associates Limited, December 2000; and to Annex E, "Technical Memorandum No. 2: Water Problem, Definition, Alternatives and Screening Approach", R. V. Anderson Associates Limited, January 2001.

¹⁰ Refer to Appendix 7, Public Consultation: Screening of Alternatives.

¹¹ Refer to Annex F, "Screening of Water & Wastewater Alternatives, Final Report", R.V. Anderson Associates Limited, February 2001.

¹² Refer to Annex G, "Stage 1 Archaeological Assessment of Proposed and Alternative Routes for Cataraqui River Utility Crossing, Kingston, Ontario", Heritage Quest Inc., April, 2001.

¹³ Refer to Annex H, "Evaluation of Water & Wastewater Alternative Routes Description of Existing Environmental Conditions Great Cataraqui River Utilities Crossing EA", Ecological Services Group International; April 2001.

¹⁴ Refer to Appendix 8, Public Consultation: Detailed Evaluation Criteria.

¹⁵ Refer to Annex I, "Technical Memorandum No. 3: Recommended Detailed Evaluation Methodology and Criteria", R.V. Anderson Associates Limited; March 2001.

On April 26, 2001, a workshop was held with the Public Advisory Committee to apply the detailed evaluation criteria to the short-list of alternatives. At that time it was understood by everyone involved that tunneling was the most likely method of construction for a new crossing, however, the committee was informed that further investigation of the dredging option was ongoing¹⁶. In the event that dredging technology proved feasible, the consultant team committed to re-evaluate the alternatives assuming dredging method of construction. This is, in fact, what took place. Analysis was completed of all short-listed alternatives assuming first tunneling and then dredging technology¹⁷.

Over the course of spring 2001, RVA investigated alternative wastewater technologies, and approaches for long-term wastewater management in Kingston. This analysis formed the basis for evaluating the relative merits of wastewater alternative 7: new WPCP west of River, in comparison to the other solutions under consideration.¹⁸

The draft preferred solution identified through the evaluation process was twinning of the watermain and forcemain parallel to the existing alignment using dredging and pipe laying construction methods. Open Houses were held June 6 and 7, 2001 to present the draft preferred solution, to solicit comments, and to answer questions of the public. Forty-three people attended over the two days¹⁹.

Throughout the study, documents were added to the web site and project updates provided via press releases and media interviews.²⁰

As no objections were received by June 15, 2001, the deadline for comments, the consultants confirmed with Utilities Kingston the preferred solution as identified. The following sections of this report summarize the information and analysis upon which the preferred solution was recommended. This document stands as the Schedule B file report for this project and will be registered on public file for a minimum of 30 days in accordance with the *Municipal Class Environmental Assessment* process.²¹

¹⁶ Refer to Annex J, "Constructability and Feasibility Report for Great Cataraqui River Utilities Crossing", C. B. Fair & Associates; May 2001.

¹⁷ Refer to Annex K, "Technical Memorandum No. 5: Detailed Evaluation of Water & Wastewater Alternatives", R.V. Anderson Associates Limited; June 2001.

¹⁸ Refer to Annex L – "Technical Memorandum 4: Wastewater Treatment Options for the City of Kingston", R.V. Anderson Associates Limited; May.

¹⁹ Refer to Appendix 9, Public Consultation: Detailed Evaluation of Alternatives.

²⁰ Refer to Appendix 10, Public Consultation: Web Site and Press Release Updates.

3.0 EXISTING SYSTEM

3.1 Water Supply

The old City of Kingston and former Pittsburgh Township are serviced by a single water treatment plant located on Lake Ontario along King Street West, referred to as the Kingston Central Water Treatment Plant (WTP) (see Figure 2.) The WTP supplies approximately 80,000 people with water through approximately 250 km of watermains, and also provides fire protection through over 1200 hydrants. The WTP presently operates at approximately 61% of its rated capacity of 118,000 m³/day (26 million gallons per day) (MGD), with average daily flows of approximately 50,000 m³/day (11 MGD) and summer peak flows of 72,000 m³/day (16 MGD).

The former Pittsburgh Township receives its water supply through a 400mm diameter watermain crossing under the Great Cataraqui River. This watermain is also common with the crossing of the sewage forcemain under the river. The crossing under the Great Cataraqui River is a 400mm (16 inch) diameter steel watermain constructed between 1955-57. The watermain is cathodically protected with magnesium anodes and is periodically tested to ensure the integrity of the cathodic protection system. The last field results (June 2000) found the system to be operating satisfactorily and above the minimum accepted criteria for corrosion protection.

The water is metered at the base of the James Street hill in Barriefield, after which flows are split between two distribution systems: one supplies the Royal Military College through a 300mm diameter trunk main; and the second supplies the James Street WBS. The original 300mm diameter watermain to the James Street WBS was twinned with a 400mm diameter watermain constructed in 1991.

Staff at Utilities Kingston estimate that only the top 455 m³ (100,000 gallons) of the total available 2,275 m³ (500,000 gallons) is presently used at the CFB Kingston tower (based upon pump cycle times recorded from the James Street WBS). The remaining storage at the CFB Kingston tower is used for fire flow protection. This under-utilization of available storage at the CFB Kingston tower leads to short cycling of the pumps at the James Street WBS.

Water consumption records for the 1998-1999 periods for areas east of the Cataraqui River (former Pittsburgh Township and CFB Kingston) are shown in Table 1.

²¹ Refer to Appendix 11, "Municipal Class Environmental Assessment", Municipal Engineers Association, June 2000.

Table 1: Water Consumption Records

Year	Minimum Day	Average Day	Maximum Day
1995	4,320 m ³ /day	5,893 m ³ /day	9,836 m ³ /day
1996	4,169 m ³ /day	6,530 m ³ /day	8,401 m ³ /day
1997	4,161 m ³ /day	5,856 m ³ /day	8,797 m ³ /day
1998	3,717 m ³ /day	5,959 m ³ /day	9,301 m ³ /day
1999	4,038 m ³ /day	6,067 m ³ /day	9,688 m ³ /day
2000	4,540 m ³ /day	6,012 m ³ /day	11,321 m ³ /day

3.1.1 James Street Water Booster Station (WBS)

The James Street WBS is located at the west end of James Street, near the eastern shore of the Great Cataraqi River. The James Street WBS was constructed in the mid-1950's by the Department of National Defense and was refitted in 1992 with three new 125 HP (93.3 kW) pumps (two duty and one standby) and a 335 HP (250 kW)²² standby diesel generator.

Fluoride is added at the James Street WBS for CFB Kingston, as a requirement of the Department of National Defense. As well, sodium hypochlorite is added to ensure adequate chlorine residuals in this part of the water distribution system.

The Ministry of Environment (MOE) Certificate of Approval (CoA) for the James Street Water Booster Station Modifications (*MOE CoA No. 7-1324-91-006*) dated November 22, 1991 notes that the upgrading of the water supply system was necessary to provide the former Pittsburgh Township with the following:

Average Design Flow - 9,020 m³/day (104 Litres/second) (2.0 MGD)

Maximum Day Design Flow - 14,500 m³/day (168 Litres/second) (3.2 MGD)

Maximum Hour Design Flow- 18,230 m³/day (211 Litres/second) (4.0 MGD)

²²(Excerpt from Part A).

²² HP = Horse Power; kW = kilowatt

The three new pumps (two are duty and one is standby) are individually capable of handling the Maximum Day Design Flow of 168 L/s against a total dynamic head of 47 metres and are driven by 125 HP (93.3 kW) nominal size electric equipped motors with reduced voltage starters. A two-pump operation in parallel can handle the maximum hour design flow of 211 L/s against a total dynamic head of 61 metres. The start/stop cycle of the pumps is controlled by preset levels in the CFB Kingston elevated water storage tank and/or the Gore Road water storage standpipe. Recent watermain breaks suggest that the station's current arrangement and operations are creating pressure transients (surges) that should be addressed during remedial works.

Additional modifications to the James Street WBS (*Ministry of Environment Amendment to Certificate of Approval No. 7-1324-91-006, dated June 26, 1995*) included the installation of a 150mm diameter water meter, a 150mm diameter pressure-reducing valve (PRV), a 75mm diameter valve and associated appurtenances. The modifications were necessary to have a complete and operating flow monitoring system on the watermain feeding the Royal Military College (RMC) and maintain the delivery pressure at or below 700 kPa²³ in the water supply line feeding the RMC (discharge pressure at the James Street WBS varies from approximately 715 to 1,100 kPa).

For more information on the existing water system, refer to Annex 5.

3.2 Wastewater

The City of Kingston sewage collection system is comprised of separate sanitary sewers (both trunk and local sewers), combined sanitary/storm sewers, sewage pumping stations (PS), combined sewer overflow (CSO) tanks and two water pollution control plants (WPCP).

In 1997, the City of Kingston amalgamated with neighboring Kingston Township and Pittsburgh Township. The old City of Kingston and Pittsburgh Township are served by Ravensview Water Pollution Control Plant; while the former Kingston Township is serviced by the Kingston West Water Pollution Control Plant. (see Figure 3.)

Sewage from the old City of Kingston flows to the River Street Pumping Station on the west bank of the Great Cataraqi River, and is pumped through a 1010mm (39.75 inch) diameter sewage forcemain under the river to a gravity sewer located on the east side of the river. From

²³ kPa = kilo Pascal

this gravity sewer, flow is carried to the Ravensview WPCP. The River Street Pumping Station and forcemain were constructed circa 1957.

3.2.1 River Street Pumping Station (PS)

The River Street Pumping Station is located at the east end of River Street, on the western shore of the Great Cataraqui River (see Figure 1). It was constructed to intercept and convey sanitary and combined sewer flows from the old City of Kingston across the river to the Ravensview WPCP. The pumping station has not been significantly modified since its construction in the 1950's, and still contains most of the original equipment including electrical equipment, and instrumentation and controls. Two of the four pumping units have been replaced from the motor down. The other two are original with the exception of normal maintenance replacement items.

Flow to the 1350mm diameter Pumping Station inlet sewer comes from nine upstream pumping stations and a network of gravity sewers serving a population of about 60,000. The inlet to the Pumping Station has an overflow chamber with an upstream flow control gate. Under normal conditions, all flow to the inlet chamber goes to the 1200mm diameter wet well inlet sewer, and through the Pumping Station to the Ravensview WPCP.

Under high flow conditions, a portion of the flow is diverted to the 1050mm diameter emergency overflow sewer, and into the river at a discharge point about 240-metres offshore. Overflow is through a flap gate, that allows bypassing to occur when the inlet chamber level exceeds the river level [about 75.0m above sea level (ASL)]. The inlet chamber level, and hence the extent of overflow, is controlled by the inlet flow control gate and Pumping Station flow rate. Throttling the inlet gate restricts sewage flow into the chamber, and in turn backs up the hydraulic grade line into upstream sewers and local Combined Sewer Overflow storage and bypass facilities. This tends to reduce overflows at the Pumping Station overflow chamber under some storm events. The Pumping Station wet well level is controlled by the pumping rate, and influences the level in the overflow chamber. The normal controlled level in the wet well is between 71.6m and 73.2m ASL. The high level alarm is at 73.5m ASL. However, if flow into the well exceeds the pumping rate, then the wet well level rises and causes an overflow in the upstream overflow chamber. Flow through the Pumping Station overflow pipe is measured by a velocity-area flow meter and data-logger that were installed in 1998. Such overflows usually occur during and after large rainfall events.

Currently, dry weather flows at the River Street Pumping Station are approximately 12 million gallons per day (MGD)(54,500 m³/day). Wet weather flows in excess of approximately 23 MGD (104,500 m³/day), which represents the maximum output for a two-pump operation, may be expected to cause an overflow at the station.

The Pumping Station wet well was designed as an aerated grit removal tank. It is open to the outside and has a clamshell bucket and crane for removing grit. Flow from the wet well goes into a submerged suction chamber to which the four pump suction pipes are attached. The pumps are identical, vertically mounted, non-clog, centrifugal pumps with 225 kW wound rotor motors. It is reported that the pumps each have a rated capacity of about 632 L/s (54,600 m³/day), and that the firm capacity (one pump out-of-service, three operating) of the pumping station is about 1580 L/s (136,500 m³/day or 30.0 MGD). The pumps discharge through a header and Venturi flow meter, into the 1010mm (39.75 inch) nominal diameter reinforced concrete forcemain crossing the river.

It has been reported that the original automatic pump controls were unreliable from start up and that the pumps have been operated manually since then with “round-the-clock”, on-site attention. During high flow conditions the station operator must control the overflow chamber inlet gate position, pump duty selection and pump speed. Pump speed is selected by multi-step resistor banks supplying the wound rotor motors. In addition, some of the upstream Pumping Stations are monitored and to some extent controlled through the SCADA system located at the River Street Pumping Station. Table 2 summarizes the pump station capacity for various conditions follows, with the source of information for each.

Table 2: River Street Pumping Station Capacity

Condition	Capacity		Source of data	Notes
	(L/s)	@ TDH (m)		
One pump rated capacity	530	34.0	Gore & Storrie 1978	see note 1
One pump vs. system curve	760	28.7	Gore & Storrie 1978	
Two pumps vs. system curve	1,410	31.7	Gore & Storrie 1978	
Three pumps vs. system curve	1,865	34.7	Gore & Storrie 1978	
Four pumps vs. system curve	2,170	37.5	Gore & Storrie 1978	
Three pumps vs. system curve	1,640	32.9	Acres & Assoc. 1997	see note 2
Four pumps vs. system curve	2,000	35.3	Acres & Assoc. 1997	
Two pumps vs. system curve	1,210		CH2M Hill	see note 3

Notes:

1. Total Dynamic Head (TDH).
2. Based on an assumed Hazen Williams pipe roughness coefficient of 120.

3. Based on a calculated roughness coefficient of between 90 and 110, established from station records between 1985 and 1996.

It is reported that only two pumps can be operated at the same time, thus reducing the firm capacity to about 1210 L/s (104,500 m³/day or 23 MGD). This operating constraint may be associated with restrictions in the pump suction configuration. However, there is no factual information to indicate a cause of the constraint. There is also an apparent reluctance to operate a third pump due to the unknown condition of the forcemain under the river, and the potential for stressing it beyond its capacity and causing an environmental incident.

The Pumping Station and ancillary facilities are well maintained and in good condition. It appears that the Pumping Station could be readily upgraded to restore or increase firm capacity and provide automation similar to other Pumping Station and Combined Sewer Overflow facilities operated by the City of Kingston, however, further investigation of this point would be required. Based on information provided by the Utilities, including the Certificate of Approval (Municipal Sewage) for the 1993 Ravensview WPCP expansion, the Ravensview plant has an instantaneous peak hydraulic capacity of 152,500 m³/day and a peak dry weather capacity of 126,800 m³/day. Therefore, the plant should be capable of handling the existing firm pumping rate of 1580 L/s (136,500 m³/day) if the Pumping Station is upgraded to restore the firm capacity.

For more information on the existing wastewater system, refer to Annex 4.

4.0 PROBLEM DEFINITION

The following problem statements were developed to clarify the scope and depth of the issues to be addressed by the Cataraqui River Utility Crossing Project. The problem statements were developed in consultation with the PAC, the TAC, and Utilities Kingston staff²⁴.

4.1 Water

²⁴ Refer to meeting notes contained in Appendices 4 and 5 for issues discussed during establishment of the problem statements.

1. The environmental, social, and economic attributes of Kingston are at risk due to the age of the watermain crossing and the lack of system redundancy that would enable the proper conveyance of both domestic needs and fire flow protection in the event of pipe failure.
2. There is no opportunity for regular inspection and maintenance of the watermain (other than regular cathodic protection surveys) due to poor operating flexibility in the system.²⁵
3. Operational constraints within the former Pittsburgh Township water distribution system including:
 - a) inadequate useable storage for existing conditions; and
 - b) high transient pressures on the suction side of the James Street Water Booster Station.

4.2 Wastewater

1. The environmental, social, and economic attributes of Kingston are at risk due to the age of the forcemain and the lack of system redundancy that would enable proper conveyance and treatment of wastewater flows in the event of pipe failure.
2. There is no opportunity for regular inspection and maintenance of the forcemain due to poor operating flexibility in the system.
3. Operational constraints at the River Street Pumping Station result in overflows of untreated sewage to the Great Cataraqui River.

5.0 ALTERNATIVE SOLUTIONS

A long list of solutions was developed to address the problem statements, and built upon the list contained in the project Terms of Reference. A set of five screening criteria was established to evaluate the feasibility of each solution, and to arrive at a short list of solutions to undergo detailed evaluation:

1. Net risk to the environmental, social, and economic attributes of Kingston is acceptable.
2. Regular inspection and maintenance of the system will be possible.
3. The solution can be undertaken in an acceptable time frame.
4. There are no more than two other options that cost less.

²⁵ In August 2000, the Province of Ontario launched *Operation Clean Water* that focuses province-wide efforts to improve water quality and delivery in the province. As part of this program, the Province introduced a new *Drinking Water Protection Regulation* (under the *Ontario Water Resources Act*) and new *Ontario Drinking Water Standards*. The program requires every municipality to provide a safe and reliable supply of drinking water in a cost effective, environmentally sensitive and sustainable manner

5. Meet the City's water distribution/ wastewater collection requirements at the river for the next 40 years.

The evaluation and short-listing of alternatives was completed in consultation with the Public Advisory Committee, Technical Advisory Committee, and general public²⁶ with the following solutions carried forward for detailed review:

Water

Alt.	Description
1.	Construct a new watermain at existing utility corridor;
2.	Construct a new watermain at La Salle Causeway;
3.	Construct a new watermain suspended from Gore-Elliott Bridge; and
4.	Construct a new submarine watermain at Gore-Elliott.

Wastewater

Alt.	Description
1.	Construct second crossing at existing utility corridor;
2.	Construct second crossing at La Salle Causeway;
4.	Construct second crossing at other location;
7.	Construct new Water Pollution Control Plant (WPCP).

As no other suitable location was found for a forcemain crossing, wastewater alternative 4 was dropped from the short-list during the detailed evaluation stage.

6.0 DETAILED EVALUATION

A set of natural environment, social, economic and technical evaluation criteria was developed in consultation with the Public Advisory Committee, Technical Advisory Committee, and Utilities Kingston staff. A notice was published March 10, 2001 inviting the public to comment on the draft detailed criteria. Weighting of the four categories of criteria was finalized as follows:

Detailed Evaluation Criteria – Main Category Weightings

Natural Environment	36%
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²⁶ Refer to meeting notes contained in Appendices 4 and 5 for issues discussed during the screening of alternatives. Reference Appendix 7 for general public feedback.

Social Environment	14%
Economic Environment	25%
Technical Merit	25%

Information used in the evaluation of alternatives was collected from a variety of sources including provincial and federal agencies, the municipality and utility, primary research by the biological, geotechnical, planning and archaeological consultants. Relative impacts and mitigating measures were assessed amongst the alternative solutions, and the evaluation results reviewed with Utility staff before presentation to the public. In summary, the preferred solution was identified as twinning of the watermain and forcemain at the location of the existing crossing. This solution was identified based upon assessment of the alternatives assuming both tunneling and dredge and pipe laying construction methods.

Table 3 summarizes the scores of the four water and three wastewater alternatives considered during this process. Key matters that were considered in determining the preference of Alternative 1 over the other solutions were the following:

- Terminus points of the existing alignment are on land owned by the City. They are previously disturbed environments with no significant species or habitats. Restoration of impacted areas is feasible.
- Operations and maintenance at the existing location disturbs the least number of residences and businesses. The neighbourhoods are already affected by the existing infrastructure and the incremental increase in activity during operations of the new facilities will be negligible.
- The cost of a wastewater crossing at the Gore-Elliott alignment was significantly greater than the other options considered and would entail significantly higher operations and maintenance costs. On that basis, it was excluded during the screening stage. The decision to carry forward the water crossing at the Gore-Elliott alignment was two-fold: first, it was feasible; and secondly, with a new water pollution control plant under consideration it was appropriate to evaluate the full range of possible water crossing locations.

Table 3: Summary of Numeric Evaluation Results

Alternative	Natural Environment (36%)		Social Environment (14%)		Economy (25%)		Technical Merit (25%)		TOTAL	
	Tunneling	Dredging	Tunneling	Dredging	Tunneling	Dredging	Tunneling	Dredging	Tunneling	Dredging
Water (W)										
1 – Existing Location	314	286	116	113	205	200	226	220	861	819
2 – La Salle Causeway	340	322	82	79	170	175	208	214	800	790
3 – Gore-Elliott (bridge)	354	354	117	120	225	225	216	216	912	915
4 – Gore-Elliott (submarine)	278	264	112	106	195	195	208	208	793	773
	out of a possible 360		out of a possible 140		out of a possible 250		out of a possible 250		out of a possible 1000	
Wastewater (WW)										
1 – Existing Location	304	284	140	140	245	240	250	250	939	914
2 – La Salle Causeway	360	336	76	80	184	214	212	212	832	842
7 – New WPCP*	166	166	42	42	35	60	159	159	402	427
	out of a possible 360		out of a possible 140		out of a possible 250		out of a possible 250		out of a possible 1000	
Combined										
W1 + WW1	618	570	256	253	450	440	476	470	1800	1733
W1 + WW2	674	622	192	193	389	414	438	432	1693	1661
W1 + WW7	480	452	158	155	240	260	385	379	1263	1246
W2 + WW1	644	606	222	219	415	415	458	464	1739	1704
W2 + WW2	700	658	158	159	354	389	420	426	1632	1632
W2 + WW7	506	488	124	121	205	235	367	373	1202	1217
W3 + WW1	658	638	257	260	470	465	466	466	1851	1829
W3 + WW2	714	690	193	200	409	439	428	428	1744	1757
W3 + WW7	520	520	159	162	260	285	375	375	1314	1342
W4 + WW1	582	548	252	246	440	435	458	458	1732	1687
W4 + WW2	638	600	188	186	379	409	420	420	1625	1615
W4 + WW7	444	430	154	148	230	255	367	367	1195	1200
	out of a possible 720		out of a possible 280		out of a possible 500		out of a possible 500		out of a possible 2000	

* Note: Water Pollution Control Plant

- Several wastewater treatment technologies were considered for installation west of the Great Cataraqui River (e.g., wetland treatment, amongst others). Only conventional tertiary treatment was identified as feasible based upon consideration of the size and population of the service area and flow rates generated, climatic conditions, site availability, and provincial regulations. The impacts of constructing a new conventional water pollution control plant north of the existing River Street Pumping Station on the Davis Estate property entailed significant natural environment and socio-economic impacts, and could not be sized to meet existing flow conditions.
- The La Salle Causeway corridor solution scored poorly because of the significant traffic, commercial, and heritage impacts it would have. There is also concern regarding hazardous materials on land west of the Great Cataraqui River that has the potential to increase natural environment and economic impacts.
- Alternative 1, which entails running pipe parallel to the existing crossing, allows for construction and maintenance of less new infrastructure since tie-in points to the existing system are readily accessible. Alternatives 2 and 3 would necessitate construction of significant lengths of watermain and forcemain to link with key pieces of infrastructure (e.g. River Street).

Initially, Alternative 1 was identified as the preferred solution assuming tunneling construction methods. Once dredging was identified as a feasible means of construction²⁷, all solutions were re-evaluated with Alternative 1 again identified as the preferred solution. Table 4 summarizes the relative impacts of both construction methods at the existing alignment. The following key factors led to recommendation of dredging and pipe laying as the preferred method of construction²⁸:

- Sediment samples collected in November 2000 were contaminated but non-hazardous and met criteria for commercial/industrial land use and disposal at a registered landfill.
- The cost of dredging is less than half the cost of tunneling (\$6-8 Million versus \$15-18 Million.)
- The Department of Fisheries and Oceans has approved dredging of contaminated sediment in fish habitats elsewhere in Ontario, using equipment and mitigating measures assumed in this evaluation.

²⁷ Refer to Annex J.

²⁸ Refer to Annex K for detailed evaluation results.

- All alterations or harm to fish and fish habitats would be reinstated/compensated in accordance with agreements signed with the Department of Fisheries and Oceans (to be established).
- The dredging operation would not interrupt water traffic.
- The duration of tunnel construction is significantly longer with greater social impacts than the dredging construction method.

More extensive sediment testing is recommended prior to final design to confirm the quantity of contaminated fill to be removed. If further investigations identify hazardous material that cannot be removed safely or in quantities that cannot be disposed of locally, it is recommended that Utilities Kingston pursue tunnel construction of the new crossing.

7.0 DESCRIPTION OF THE PREFERRED SOLUTION

The preferred solution is construction of a watermain and forcemain, parallel to the existing watermain and forcemain that run beneath the river from the City's River Street property on the west shore of the Great Cataraqui River to the City's property at the base of James Street on the east shore, (see Figure 4.) The following sections address several of the matters to be covered during completion of the federal Environmental Screening Report. Outstanding issues will be addressed during the preliminary design stage of this project as additional investigations are completed and more details become known.

7.1 Project Components, Structures and Activities

7.1.1 Proposed works

- Construct new watermain from the intersection of Cataraqui Street and Rideau Street, along Cataraqui Street, beneath the Great Cataraqui River parallel to the existing alignment to the existing James Street Water Booster Station (WBS).
- Rehabilitate the existing watermain (re-line).
- Improve efficiency and effectiveness of James Street WBS.
- Improve River Street Pumping Station (PS) to convey design flows for forty-year period, including full replacement of pumps and controls, and correction of existing deficiencies.

- Construct a new forcemain from River Street Pumping Station, beneath the Great Cataraqi River parallel to the existing alignment to link with existing forcemain on east shore.
- Rehabilitate the existing forcemain (re-line).

7.1.2 Associated works

- Lease or construct temporary dock space for barge offloading in the inner harbour.
- Construct a temporary road access across Department of National Defense property, linking Constantine Drive to James Street at its base.
- Remove vegetation from municipal property to allow for construction staging area.
- Construct a temporary access at the west end of River Street, linking it to Rideau Street.

7.1.3 Construction activities

- Dredge a channel approximately 5m wide and 3m deep and 1030m in length. Drill and blast will be used where bedrock is encountered (for approximately 100m of the crossing.)
- Extract sediment and transfer to sealed scows using a cable arm clamshell bucket operated from a barge.
- Transport sediment and other extracted materials to temporary dock via sealed scows and tug boats.
- Transport sediment and other extracted materials to registered landfill site (in accordance with Ontario Regulation 558/00 and other relevant legislation) using sealed dump trucks.
- Install silt screens around barge, dewatering facility, and perimeter of work area to contain suspended solids.

7.1.4 Project Timing and Schedule

- Dredging and pipe laying works will take approximately 3 months to complete.
- Blasting, dredging and pipe laying works will take approximately 2 months to complete.
- On land open cut and blasting works will take in the order of 1 month to complete.
- Upgrades to the River Street Pumping Station will take approximately 6 months to complete.
- Upgrades to the James Street Booster Station will take approximately 6 months to complete.

- All on-water works can be completed between May and October.
- The year of construction is unknown.

7.2 Construction materials, handling and disposal

Analysis to this point has assumed use of high density polyethylene (HDPE) pipe, with the sections assembled by thermal butt fusion without mechanical joints which makes the entire pipe length very flexible and therefore, suitable for use in soft soil conditions. The pipe would be held in place using concrete ballast weights. Thermal butt fusing of the pipe would occur on-shore within the staging area.

River sediment is contaminated and requires special handling and disposal. Samples taken and analyzed during the November 2000 drilling investigation met the criteria for commercial/industrial land use under old Regulation 347; and the limits for disposal as a non-hazardous, non-registerable waste at a registered landfill. Additional geotechnical testing is required to better quantify and assess river sediment quality under new Ontario Regulation 558/00 and other relevant legislation, and thereby enable selection of the dredging route, and development of an appropriate sediment handling and disposal plan.

7.3 Project Site and Environment

7.3.1 West side

The existing River Street Pumping Station property forms the western land terminus of the watermain and sewage forcemain, (see Figure 4.) The two-acre property is owned by the City. West of the pumping station, also on the south side of River Street, is the Warner Jenkinson (Can.) Ltd. manufacturing plant. South of these properties is Emma Martin Park, the Cataraqui Canoe Club, the Kingston Rowing Club, and a parking lot for the Woolen Mill on Cataraqui Street. North of these properties is a vacant parcel of scrub and brush known as the Davis Tannery site, part of a 34 acre site owned by the Davis Estate. The western portion of River Street dead-ends at an abandoned railway line, just east of Rideau Street. There is a semi-detached house straddled over two large lots on the north side, and several large (2-storey) fuel storage tanks (Rosen Fuels) on the south side enclosed with security fencing. At the north (dead end) of Orchard Street is a one-acre property used for commercial-industrial purposes by Jackson Chimney Cleaning.

Most of the River Street area is designated "Residential" in the old City of Kingston Official Plan (July 1991.) The Wellington Street waterfront area and Emma Martin Park are designated "Open Space" and the Woolen Mill designated "District Commercial".

Land abutting the west shore at the location of the proposed crossing consists of manicured grass to the edge of the water bordered by rip-rap, resulting in large flat boulders and cobbles covered by a thin layer of sediment. Submerged vegetation and floating mats of weeds were observed along the west shoreline during the August 2000 field survey. However, there were no remnant cattails along either shoreline. Prior sampling of sediments and forage fish showed PCB contamination.²⁹

The aquatic environment provides habitat in terms of nursery, spawning beds and migration routes for various species including pike, small mouth bass, large mouth bass, lake trout, perch and sunfish. Along this route, the aquatic habitat is characterized as floating mats of weeds, submerged vegetation, shallow water depth, averaging between 1.2 and 2.0 metres in the channel and velocities averaging 0.02 m/s. The floating vegetation enhances the habitat benefit for waterfowl. A 1989 inspection of the pipes indicated that fine sediments along the existing corridor were approximately 0.91 m deep, with a maximum water depth of 1.4 metres.

7.3.2 East side

The eastern terminus of the existing watermain and sanitary forcemain is in a small wooded area at the base of James Street near the water's edge on a 1 acre parcel owned by the City (see Figure 5.) There is an informal gravel boat ramp and a dirt road that ends in a roundabout. The property is surrounded by scrub and bush land owned by the Department of National Defence. There are five small water lots immediately east of the City's lot owned by Transport Canada, and four homes on Green Bay Road, which extends from James Street parallel to the river for approximately 0.25 km. South of James Street is a pumping station and water booster station owned by the City, and sports facilities and fields of the Royal Military College.

The on land terminus of the existing pipes is designated "Open Space" in the old Pittsburgh Township Official Plan (consolidated January 1996), as are properties immediately east and west of the site. The remaining land east of the site comprising the Village of Barriefield, is

²⁹ Refer to Annex C.

largely designated "Low Density Residential". The entire CFB Kingston is designated "Institutional". The base has no master development plan.

There is little aquatic vegetation along the east shoreline, and the substrate consists of gravel and boulders with little fines. Sediment sampling undertaken in November 2000 yielded the following:

The land next to the James Street WBS consists of manicured areas, roads and parking lots. The vegetation and wildlife observed during the winter 2001 survey included willow and maple trees, common burdock, gray squirrel and a small woodchuck den. The trees are scattered, providing 30 to 60 percent cover, with a dbh (diameter at breast height) range of 15-25 cm.

The entire length of the proposed alignment was previously disturbed by development including construction of the existing WBS, the existing watermain and sewage forcemain, access roads and the existing utility corridor along residential streets.

The archaeological potential of the corridor is regarded as high, despite previous disturbances in the area. An underwater scow or barge (BbGc-37) is located in proximity to the preferred utility corridor.

7.4 Fish, fish habitat, and navigable waters

The Cataraqui River Conservation Authority (CRCA) and Parks Canada have stated that this reach of the Great Cataraqui River is not significant fish habitat. Preliminary assessments carried out by ESG International Inc. for the purpose of this study indicate that the following impacts can be anticipated:

- Temporary destruction of spawning and rearing habitats for fish, and shoreline and water habitat of amphibians, aquatic birds and some mammals (e.g. muskrats.)
- Spring spawners may be affected depending upon the time required for new vegetation to become established.
- Limited fall spawning in the area for Lake Trout due to unsuitable substrate and/or silt covering the substrate.
- Potential interference of fish movement including fall spawners such as Lake Trout.
- Potential interference with marine traffic.

The following measures have been proposed to mitigate these impacts:

- Use silt curtains and cable arm clamshell bucket to minimize sediment disturbance and contain suspended solids and contaminated sediment.
- Use sealed scows to transport sediment to shore to minimize release of sediment outside of silt curtains.
- Avoid in-water work during high flow conditions and during periods of high winds that cause wave action.
- Carry out all operations and handling/storage of toxic materials on land to the greatest degree possible (e.g. storage/disposal of excess material and waste water, equipment refueling, storage of fuel, lubricants, and other chemical).
- Monitor fish habitat visually and test turbidity during construction for any changes in sedimentation or in-stream structure, sediment plumes, detached aquatic plants and disturbances to substrate.
- Maintain portion of navigable channel open at all times. Use appropriate mechanisms to direct marine traffic while working in the channel.

8.0 NEXT STEPS

Several activities should occur prior to final design and implementation of the recommended solution, namely:

1. Register this Schedule B File report on public file for a period of no less than 30 days, with notification and circulation of concerned parties (including the Ministry of Environment) in accordance with the *Municipal Class Environmental Assessment* process.
2. Confirm ownership and the terms of use of the existing easement with Transport Canada.
3. Complete the preliminary design of the crossing and related works including identification and assessment of potential docking and disposal facilities, and the development of a program of mitigating measures to minimize impacts during construction and operation of the new infrastructure. To this end, complete additional geotechnical, fish and fish habitat investigations in consultation with concerned federal and provincial approval authorities (i.e. Department of Fisheries & Oceans, Department of Environment, Department of National Defense, Ministry of Environment, Ministry of Natural Resources, and the Cataraqui River Conservation Authority.)

4. Prepare and submit for approval a federal Environmental Screening Report in accordance with the *Canadian Environmental Assessment Act* (CEAA). Obtain other federal and provincial permits and approvals as required once CEAA approval is given (e.g. navigable waters, dredging, construction of a docking facility.) Note, this report fulfills several federal environmental assessment requirements.³⁰

Yours truly,

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³⁰ Refer to Annex M, "CEAA Environmental Screening Report" Transport Canada.