**PROJECT COMPLETION REPORT (SCHEDULE G)**
**GREEN MUNICIPAL FUND**
**& FEDERATION OF CANADIAN MUNICIPALITIES**

**Project information**

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| GMF number: | 10286 |
| Name of funding recipient: | The Corporation of the County of Prince Edward |
| Project title: | Picton Wastewater Treatment Plant Replacement |
| Date of Report: | AUGUST 27, 2012 |



This project was carried out with assistance from the Green Municipal Fund, a Fund financed by the Government of Canada and administered by the Federation of Canadian municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

**Project implementation**

1. **Project Timelines:**
    a. The project was initiated in 2003 when PEC retained KMK Consultants to develop and ESR study (Class Environmental Assessment Wastewater Treatment Capacity Picton-Hallowell) which was completed in November 2006. The study proposed a new extended aeration plant with tertiary treatment at a new location as the preferred option.
    b. PEC then retained engineering services for the design of the new plant which was completed in late 2007. The design went to tender in January 2008, however all bids received were significantly higher than the budgeted cost and PEC decided not to award the contract.
    c. Following considerable community group input to the project direction, and Staff and Council investigation, PEC determined to follow an "alternative services delivery" solution (Design, Build and Operate - DBO or Design Build, Operate and Finance - DBFO) and retained a specialist in this type of approach to guide Staff and Council through the Request for Proposal development.
    d. A Request for Expressions of interest (RFEI) was issued with a closing date of September 4, 2008, following which seven replies were received. An assigned Steering Committee under the guidance of the DBO/DBFO Consultant developed a short list of three firms.
    e. A Request for Proposal (RFP) for Alternative Services Delivery was issued to the three short-listed firms on 3 December, 2008.
    f. The Steering Committee struck an RFP Evaluation Committee to review the three proposals. All three bids were again significantly higher than the budgeted amount and some technical proposals were unacceptable. It was also apparent that the capital and operating cost savings sought under the election for the "alternative services delivery" were non-existent.
    g. With the existing plant rapidly deteriorating, and secured funding jeopardised by the absence of a viable economic and technical proposal, the Steering Committee determined to negotiate with the firm that had submitted the preferred technical solution, which was also closest to the recommendations of the EA and the previous design consultant, and was the lowest of the compliant bids.
    h. Value Engineering sessions were held on 16 and 17 April 2009 as a result of which, significant cost reductions were achieved without impacting the functionality, quality or performance to be expected of the new facility. The committee submitted its report to the Steering Committee on 25 May 2009, recommending "*that the RFP process be terminated and that all three Proposals be rejected".*
    i. On June 11, 2009, Council approved a motion to award a Design-Build contract to Maple Reinders.
    j. The project achieved Substantial Performance on 14 December 2010 and the new facility began treating sewage on 14 February, 2011. By

18 February 2011, the existing plant had been shut-down and all sewage re-directed to the new facility for treatment.

k. During the eighteen months of operation, plant effluent quality has met or exceeded all Certificate of Authorization criteria. Other than the incident described in Section 3.b below, there have been no major operating problems. Project Deficiencies continue to be addressed, but are now minor in nature. The following items of note occurred during this period:
    i. There was a failure of the Septage System, discovered to be due to rocks by-passing the inlet rock-trap and becoming trapped in the flow-control valve. This is a result of haulers having to pressure-discharge the final contents of their trucks, due to a slight elevation difference between the truck discharge line and the septage System inlet. This is being addressed. The Septage System has redundant pumps to transfer from the well to the digester, but only a single inlet and treatment unit.
    ii. An anoxic zone mixer failed; it was returned to the vendor who could not find a problem with the unit.
    iii. The scum pump failed – subsequently a failed starter relay component was found and some wiring corrections were made.
    iv. During final ESA inspection, the inspector issued a requirement to change the lugs on the auto-transfer switch at the Pumping Station. Modifications to the Power Monitors at both the Pumping Station and WWTP main Motor Control Centres (MCCs) were also needed. These two items required complete electrical shut-downs at each location. The shutdowns were successfully completed during the week commencing August 13, 2012 with no incidents.

**2. Community Involvement:**

a. During early ESR, design stages, frequent information sessions had been held; these sessions led to the formation of groups of some like-minded individuals.
b. Several community groups and a few individuals addressed Council and Staff at points throughout the project, in particular being vocal in pressing for the “alternative services delivery” option. Recognition of these member’s views led to Council and Staff adopting the DBO and DBFO options after having visited sites where similar projects had been implemented.
c. Community groups also pressed for the use of new technologies such as the “living machine” process, and options which had largely been considered and rejected during the ESR and design stages by the consultants retained at the time.
d. While it could be said that the groups strongly influenced the choice of a DBO/DBFO direction, which failed to deliver the savings they promised it could, and hence introduced a delay into the project implementation, their involvement has to be recognized as ensuring all possibilities were thoroughly reviewed.

e. A member of the most active community group was seconded onto the Public Works Sub-Committee during the DBO/DBFO document development.

**3. Project Implementation:**

a. Other than a change in the Substantial Performance date from 31 October 2010 to 14 December 2010 as a result of bad weather delays, the contract has been performed as specified.
b. Abnormally high rainfall in mid-March 2011, only a couple of weeks after operation commenced, resulted in clogging of filters, with a subsequent minor environmental spill. The cause was quickly identified as a combination of circumstances, and remedial actions determined as outlined below:
    i. Baffles on the Aeration Tank discharges to the Secondary Clarifiers to eliminate possible “short-circuiting” of the clarifier under high flow situations (this was the cause of excess solids being introduced to the filters in a very short period and blocking them).
    ii. A revised pumping strategy for the Pumping Station that will ensure that flows through the plant will not exceed design levels, combined with an automatic shut-down of Aeration Blowers that will temporarily collect higher solids in the Aeration Tanks and prevent overloading of Clarifiers.
    iii. The tertiary filters are to be fitted with an automatic backwashing control system. This was not available at the time of contract award, but will ensure effective backwash at all ranges of plant flow, and will also reduce energy consumption by reducing the amount of backwash water re-introduced into the process.
    iv. A piping “by-pass” and weir system that will route pumped flows in excess of what the filters can handle, around the filters yet through the Ultra Violet Disinfection.
c. The first two items were completed early in the year. The last two enhancements to the process required submission of an Amendment to the Certificate of Authorization for the plant. Approval of the Amendment was received on 19 March 2012, and the work will commence during the first or second week in September, 2012.

**4. Economic Benefits**

a. The driving force behind this project was the replacement of a 60-years old facility that had little or no redundancy, aging and hard-to-replace equipment and was reaching capacity with no room for expansion. Hence it is difficult to pin-point economic and social benefits other than to say that an essential public wastewater treatment service is now assured for the next 60 years.
b. The design implemented includes the ability to expand the plant treatment capacity in the future, by conversion of digester and sludge holding tanks to a third aeration/clarifier stream, contingent on PEC

developing an alternative bio-solids management approach. Presently sludge dewatering and disposal is by an outside contractor.

c. While the plant is new and uses current technology and recognized best-practices equipment, and has some degree of automation, because of the increased size and complexity, staffing needs may increase until such time as adequate operators have been trained.
d. While significant funding was obtained for the project the net cost to the municipality is $17.4 million.

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| TOTAL PROJECT COST | $28,725,000 |
| (LESS) APPROVED COMRIF FUNDING | $10,320,960 |
| (LESS) GREEN MUNICIPAL FUND GRANT | $1,000,000 |
| | |
| NET TOTAL COST TO COUNTY | $17,404,040 |

This net cost amount will be financed by GMF and Infrastructure Ontario loans and while the interest rates for both loans are below market rates the repayment of the loans will require substantial increases to sewage rates and connection charges for the service users in Prince Edward County.

e. Initial estimates indicated that while operating costs would be somewhat higher as a result of electrical consumption (pumping, blowers, the use of Ultraviolet Disinfection), maintenance costs at least in the short-term would be minimal with few consumable items.
f. As discussed in “b.” above the plant has been designed for expanded capacity at a relatively low cost allowing for future connections and the development of additional housing and businesses within the serviced area.

**5. Social Benefits**

a. The new facility has improved the quality of air for residents in the vicinity; the old plant developed odor problems at certain times of the year, and is now de-commissioned and awaiting demolition, while after a year of operation at the new location, no odor problems have been detected (a comprehensive odor-control system was installed in the Head Works Building).
b. The forthcoming demolition of the old facility will remove all buildings, tanks and return a significant area of the Delhi Park location to grasslands and native shrubbery, and eliminate what has been a constant eyesore throughout its life.
c. Both the new Treatment Facility and Pumping Station are comprehensively fenced and also access to buildings and process areas are alarmed against intrusion.

**6. Lessons Learned:**

a. Contract Format:

i. Barrier: Initially the project was planned as a traditional design and tender approach. This resulted in bids coming in over-budget; even by adding the options for a contractor to operate the facility and offset capital cost against future income, or finance the project and make money on their investment, prices were excessive.
ii. Solution: This project was a “design/build” contract with a General Contractor and Consulting Engineer working together to provide the technical solutions and resolve construction issues as a team, rather than as often happens, opposing forces. The arrangement resulted in capital cost reductions, because the design was tailored for cost-effective construction. It also enabled the design/build team and Owner to work together in a Value Engineering exercise to determine what was essential, and what facilities could be eliminated or modified without detriment to the project intent.

b. Project Successes - 1:
   i. Barrier: Funding for the project in part came from COMRIF which placed some severe time constraints on project completion. The two failed tenders exacerbated construction schedule constraints on the eventual Design/Build contract and made it look almost untenable.
   ii. Solution: The Contractor made the decision to continue pouring concrete for tanks and foundation throughout the winter of 2009, enabling them to be ready to install mechanical equipment in the spring. If this decision had not been taken, Substantial Performance (SP) could not have been achieved by COMRIF’s required dates.

c. Project Successes – 2:
   i. Barrier: With SP occurring in winter, and subsequent commissioning of the new equipment taking place in sub-zero temperatures, water pressure and leak testing of vessels proved time-consuming. Equipment inside tanks such as clarifier mechanisms and aeration diffusers could not be left un-submerged, but ice-build up was a constant issue. Additionally, transfer of sewage from the old plant to the new facility included transfer of existing sludge inventory as well as diversion of four main sewers feeding the old plant that had to be re-directed to the new Pumping Station. Sewage is biologically sensitive to temperature so speedy transfer and accumulation of a substantial mass of process liquid at the new plant was paramount.
   ii. Solution: The Contractor and Operations team worked together to effect the transfer of the old plant contents as smoothly as possible. Glycol heating coils were used to melt ice surfaces and

steam generators and heating mats were also employed. A work-plan for the sewage transfer was prepared, together with contingency plans which were reviewed with the local MOE Office. Transfer of the sewage was successful and the old plant was taken off-line three days after sewage was introduced to the new plant.

d. Teamwork:
   i. Barrier: Successful Design/Build demands buy-in from the Owner, and during the early stages of the contract development, the Value Engineering and the Project kick-off, there was a strong sense of team spirit which produced an effective team. Unfortunately, three key staff who had been intimately involved, the Public Works Commissioner, the Plant Superintendent and the County Engineer all left PEC employ within about a month after the contract award. A new Commissioner did not come on board until late in the year and he and the staff taking up the Superintendent and Supervisor positions felt little loyalty to the project at the start.
   ii. Solution: The lack of involvement felt by these individuals has possibly not even now been totally overcome, a scenario which is understandable, since, had they been involved, different operational decisions would possibly have been made at the VE workshops, for example, which would have made their present operating regime more to their liking. However, staff change is a fact of life, and became an issue on the project even though every effort was made at the beginning to bridge the gaps. The new Commissioner had also had poor previous experience of Design/Build projects and was initially skeptical of the approach. All parties have continued to bring a positive attitude to resolution of these issues and changes to the original design have been brought about via Change Orders as necessary.
   iii. Future Projects: From our project experience it appears that the depth of staff involvement was possibly inadequate, although the detail of involvement of the senior staff was higher than average; even though supervisory were involved in detailed discussions, junior staff was not brought up to speed. It became apparent that they did in fact have much to contribute to the design process.

e. Project Knowledge:
   i. Automation: While all equipment packages are essentially self-contained and control themselves, with statuses and alarm conditions being monitored centrally, some items were down-graded to manual operation during VE as staff felt that the cost-savings achieved justified the decision. These included electrically actuated valves to bring standby blowers and pumps into service, and operate filter isolation valves. Also the decant

systems were changed from automatic to manual. While alternating blowers has not been an issue because of capacity - see below, the decant system is cumbersome and time-consuming. The original units would not have had these issues, although cost-savings were achieved.

ii. Blowers: Latest technology Neuros turbine blowers were adopted as an optional item within the contract price. They are quiet and efficient, however they appear to have been oversized and this is currently under review with the Design/Builder.

iii. Equipment Database: Throughout the project, the Contractor used a spreadsheet interface to a document database where all project record documentation was stored: Vendor Installation Certificates, Calibration records, Loop check sheets, Shop Drawings, Vendor Operation Manual. This interface and database will be made available for PEC use once all records are loaded.

f. New Technology/New Approach:

i. Contract Model: In today's municipal construction projects, adoption of a Design/Build model is still a fairly rare choice. As noted above, its selection for the Picton project was not the first choice; however it did prove to be an effective and successful approach, both in terms of schedule and budget. While completion of deficiencies extended far later than was anticipated, some of this work such as landscaping was weather-related and needed to be postponed until the warmer weather. The project has benefited from the present uniqueness of the design/build approach in that the Contractors Team may have been particularly motivated to deliver a good product to assist in the project being a "success-story model" for their future work in the design/build field.

ii. Energy Conservation: Numerous design decisions were made aimed at reducing energy consumption, which were influential in PEC being Awarded Green Municipal funding. Three items are worthy of note here:

1. External Lighting: The original design included photocell operated external lighting for walkway and building lights. However, the plant is not manned at night time, and occupies a highly-visible location on the slope across from the down-town area. It was decided that manual control of the lights would reduce power consumption further – other than door-way illumination, lights are only turned on at night when staff are called to the plant. Also the majority of the walkway lights (which were high wattage overhead style lamps) have been exchanged for walk-way level LED lights with low consumption, long life and less night-sky light pollution as the light is very focused.

2. Effluent Water Generator: The location for the new facility dictated that sewage is pumped up to the Treatment Plant and in an attempt to salvage some of this pumping energy, the original design included a turbine installed on the effluent discharge piping to generate electricity and offset the Pumping Station Hydro costs. All functionality to allow a generator to be installed in the future has been provided, but due to lower sewage flows than anticipated, no generator has been installed yet.
3. Filter Wash-water: As noted in 3.b.i) above, the planned enhancement to the Filters will not only improve filter performance, but will be less energy-consuming, and promises a 90% reduction in backwash time corresponding to about 90% reduction in backwash volume – which is water that normally goes back through the treatment process.

g. Lessons learned from this Project:
   i. The planning for this project and determination of the best Contract Model was very time consuming, in part driven by the concerns of citizens/users. The additional planning period resulted in higher project costs than initially estimated. Additional consultation with stakeholders at the start of the project to include the determination of a firm procurement plan would be undertaken for any future large/complex projects of the municipality.

h. Project Champion:
   i. The previous Public Works Commissioner, Steven M. Carroll, P. Eng., was a champion for the project and instrumental in getting the project initially off the ground and subsequently through all of its intricacies before the eventual contract award. Steve retired in June of 2009 and tragically succumbed to a sudden illness in October 2010.
   ii. Another Champion was Leo Finnegan, who was Mayor at the time, and took an active and hands-on role in guiding Council and Staff through the several years of lead up. Leo has since retired from Council and his contact information is below:

   Mr. Leo Finnegan
   13 Low Street, Picton, ON, K0K 2T0
   Tel. 613-476-5714

**7. Next steps:**

a. Bio-solids: PEC Council has placed a moratorium on the spreading of bio-solids waste from the Picton and Wellington WWTPs within the County. This resulted in significant modification to the first bio-solids

treatment proposals; the initial proposal - a centrifuge - was not cost-effective and the second – use of geo-tubes – was excessively labour-intensive and had a large footprint. The eventual decision was to retain the same third-party dewatering and disposal firm to manage the bio-solids. There is an operational cost to this, however, the future of the wastewater bio-solids disposal process is now part of PEC's greater waste management plans and is referenced in the County's Integrated Waste Management Master Plan (2009) document. It is seen as raw feed stock for a future area wide organics composting program. On 28 March, 2012, the County issued an Expression of Interest jointly with the cities of Belleville and Quinte West to begin this process in earnest. The bio-solids will be processed (de-watered) to the required specifications of the compost service provider and shipped to them for conversion.

## 8. Publicity

a. The project was extensively photographed throughout its duration and "current status" photographs were displayed on the PEC website, as well as on a revolving slide show in the Shire Hall foyer. These have now been taken down.
b. The County of Picton has a very open and accessible program of meetings that have a gallery open to the public, at which progress reports were regularly presented by the Commissioner.
c. Substantial Performance Milestone Ceremony, November 26, 2010 - extensive local press coverage.
d. Grand Opening/Ribbon Cutting, August 7, 2012 - extensive local press coverage.

## 9. Photos and materials

a. Photographs of the project are included in this package. Thumbnails are provided below for easy reference:

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|  | Filter Building ironwork in foreground, top of Blower Building and Aeration Tank in background. |
|  | Coring holes through the Blower Building walls through to the Aeration tanks. |

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|  | Tying in the new sewers and manholes at the Pumping Station. |
|  | The new Effluent Discharge into Marsh Creek. |
|  | PEC Operations staff receiving “on-the-job” training from HVAC vendor personnel. |
|  | View over the Secondary Clarifiers, looking towards the Blower Building and Aeration Tanks. |