

## **SCHEDULE A**

# **NATIONAL ENGINEERING VULNERABILITY ASSESSMENT OF PUBLIC INFRASTRUCTURE TO CLIMATE CHANGE**

## **CITY OF WELLAND INFRASTRUCTURE ASSESSMENT**

**Work Statement  
October 2010**

### **1. Background**

Engineers Canada, the business name for the Canadian Council of Professional Engineers, established the Public Infrastructure Engineering Vulnerability Committee (PIEVC) to oversee the planning and execution of a broad-based national engineering assessment of the vulnerability of Canadian public infrastructure to changing climatic conditions. The uncertainty caused by changing climatic conditions may be undermining the meteorological data used to design infrastructure.

This National Engineering Vulnerability Assessment is a long-term project to evaluate the changes anticipated to the risks to Canadian public infrastructure posed by climate change. PIEVC selected the City Of Welland's infrastructure vulnerability for review. The priority areas include stormwater and wastewater systems and water resource systems.

It is anticipated that the results of this work will lead to recommendations concerning the review of infrastructure codes, standards and engineering practices to accommodate future climate change anticipated over the service life of these categories of infrastructure.

For the purposes of this study, engineering vulnerability to climate change is defined as the shortfall in the ability of public infrastructure to absorb the negative effects, and benefit from the positive effects, of changes in the climate conditions used to design and operate infrastructure. The vulnerability is a function of:

1. Character, magnitude and rate of change in the climatic conditions to which infrastructure is predicted to be exposed;
2. Sensitivities of infrastructure to the changes, in terms of positive or negative consequences of changes in applicable climatic conditions; and
3. Built-in capacity of infrastructure to absorb any net negative consequences from the predicted changes in climatic conditions.

Engineering vulnerability assessment will, therefore, require assessment of all three elements above.

The principal method being used to develop a national picture of the engineering vulnerability of infrastructure to climate change is through selective case studies of individual infrastructures or infrastructure systems.

This assessment not only requires a definition, and projection of climatic design parameters, but also the definition of the characteristics and components of the infrastructure, which make them more or less vulnerable to climate change. These can include, but are not limited to: age and condition of the infrastructure, maintenance practices, the rate at which system is upgraded or replaced, system characteristics, geographical limitations on the system, other factors affecting sustainability of the current system (e.g. population growth), the variation in design standards across the country, policies and incentives and other factors that may be identified.

The City Of Welland has agreed to work with Engineers Canada and the PIEVC to assess the engineering vulnerability of wastewater and surface drainage collection systems to the impacts of future climate change.

The Consultant is directed to the PIEVC website ([www.pievc.ca](http://www.pievc.ca)) to review the first national assessment report completed in April 2008, which includes reports on seven case studies. Particular reports in the infrastructure category should be consulted in the preparation of proposals for this project.

## **2. Objectives**

The principle objective of this case study is to identify those components of the wastewater and surface drainage collection systems that are at risk of failure, damage and/or deterioration from extreme climatic events or significant changes to baseline climate design values.

The nature and relative levels of risk are to be determined in order to establish priorities for remedial action. The assessment shall be carried out using the PIEVC Engineering Protocol, Version 9 dated April 2009.

The results of this case study will be summarized in a report (the "Case Study Report") as per the PIEVC protocol. Findings of this case study will be incorporated into a national knowledge base and analyzed with other case studies to develop recommendations around reviews of codes, standards and engineering practices.

## **3. Study Scope and Timing**

The location of the wastewater collection system and surface water drainage system to be studied are owned and operated by the City of Welland.

Welland is located in the Niagara Region in Ontario. The scope of the assessment encompasses the current design, construction, operation and management of this infrastructure as well as any planned upgrades or major rehabilitation project in the planning stages.

The study is to address potential impacts of future climate change for the decades of 2020 and 2050.

#### **4. Work Statement**

1. Define the infrastructure components for the wastewater collection system and surface water drainage system for the City of Welland that encompass its design, construction, management, operation and maintenance.
2. Identify and document the applicable design codes, standards, criteria as well as applicable policies, best practices and procedures for each of the infrastructure components as available through design and operational specifications, as-built drawings etc. at the time when the infrastructure was designed and constructed, where such information exists and is available. The consultant shall also identify and document any site-specific operational requirements. This task shall specifically focus on climate parameters and infrastructure indicators i.e. relevant infrastructure climate performance design/operation criteria as defined by these documents and standard operating practices.
3. Using professional judgment and experience review available climatic data relative to the project location and assessment time horizon. Based on this review establish for each climate parameter and infrastructure indicator (relevant infrastructure climate performance design/operation criteria) the probability of a climate change event affecting the infrastructure or infrastructure component in a manner that adversely affects the functionality of the infrastructure.
4. Using professional judgment and experience, determine the likely effects of individual; climate events on individual components of the infrastructure, using the assessment matrix and process described in Step 3 of the PIEVC Engineering Protocol, Version 9.
5. Undertake consultations with the City of Welland management, planning, engineering, operations and maintenance staff. This consultation must include the convening of a workshop with participants from Welland, the Consultant's Project team, the PIEVC Project Advisory Group and climate experts as appropriate.
6. In accordance with Step 5 of the PIEVC Engineering Protocol Version 9, provide recommendations to address the engineering vulnerabilities

based on the critical infrastructure-climate interactions identified in previous steps.

7. Prepare a report that includes and Executive Summary, description of the baseline and projected climatic parameters, identification and description of the infrastructure components and the assessment of the engineering vulnerabilities and recommended remedial actions.

## **5. Project Management**

The Case Study will be conducted by the City of Welland in partnership with Engineers Canada, which operates the PIEVC Secretariat. These parties will form a Project Advisory Committee as defined in section 2.4 of the attached Memorandum of Agreement (the "Agreement") (between The Corporation of the City Of Welland and the Canadian Council of Professional Engineers, doing business as Engineers Canada) to provide outside expert advice and review of documentation to the City of Welland to ensure it meets their needs as well as the National Engineering Vulnerability Assessment project.

The Project Advisory Committee will support the project by:

- Providing members from the relevant PIEVC Expert Working Group to serve for the duration of the project and supported by the PIEVC Secretariat;
- Providing ongoing advice to the City of Welland as well as the Consultant as required;
- Ensuring compliance of the case study with the PIEVC Engineering Protocol;
- Reviewing the case study draft report and providing comments to the City of Welland Project Manager. defined in Section 1.1 of the attached Agreement).

The City of Welland will appoint a Project Manager who will have the responsibility to manage all technical and financial aspects of the project. She/he will serve as the point of contact with the Consultant Project Manager (the leader of the project for the Consultant). The Case Study Report will be approved through a sign-off by the Welland Project Manager or other authorized person.

## **6. Deliverables**

The required deliverables include a work plan, draft and final versions of the case study report, completed Excel spreadsheets and two versions of a powerpoint slide presentation.

## **6.1 Work Plan**

Within four weeks after award of contract, the Consultant will submit a work plan in draft and, after review, final form that provides:

- Further details on the technical experts who will be engaged and their roles and responsibilities within the Consultant's Team
- Further elaboration on the technical approach outlined in the Consultant's Proposal and any deviations
- A listing of potential issues that will require decisions by the City of Welland
- Listing of infrastructure and climatic data requirements and a preliminary assessment of significant data gaps
- A proposed project schedule that includes key milestones and identifies particular actions of the City of Welland and/or the Project Advisory Committee, and
- Details on the operation of the project, e.g. meetings, teleconferences, summaries of action items for subsequent meetings and so forth.

## **6.2 Monthly Progress Reports**

The Consultant shall provide brief email progress reports to the City of Welland Project Manager that:

- Report on monthly progress against the work plan;
- Document technical issues and key decision points; and
- Identify any technical, financial or management issues that require resolution and/or have been resolved during the reporting period.

A copy of the report should also accompany the monthly invoice.

## **6.3 Case Study Report**

The Consultant will submit a draft final report on the results of the vulnerability assessment for the review of the City of Welland and the Project Advisory Committee. Following its review and responses to comments, a final version shall be submitted to the City of Welland.

The final report should incorporate the following elements:

1. An executive summary of not more than 10 pages providing a synopsis of key findings and recommendations from the Case Study suitable for use to brief stakeholders;
2. A second version of the executive summary (not more than 10 pages) presenting the findings and recommendations for remedial

actions for a non-technical audience at the decision-maker level e.g. regional councilor.

3. Listing of assumptions used, engineering judgments made and limitations of the analysis.
4. A description of the current and projected climatic parameters of interest which are relevant to the design, development and operation of the infrastructure.
5. Results of the engineering vulnerability analysis including the vulnerability analysis matrix.
6. Listing of potentially vulnerable infrastructure components and the description to climatic parameters.
7. Recommended remedial action(s) to address potentially vulnerable infrastructure components.

The final report shall be submitted in Microsoft Office 2003 format as well as Adobe pdf.

6 hard copies of the final report shall be delivered to the City of Welland.

#### **6.4 PIEVC Engineering Protocol Worksheets**

The Consultant is required to submit fully completed Microsoft Excel 2003 worksheets that document the results of each step of the PIEVC Engineering Protocol.

#### **6.5 Case Study Presentations**

The Consultant shall prepare a 20 minute presentation and slide deck on the key findings and recommendations from the case study for use by the City of Welland, the PIEVC Secretariat or members of the Project Advisory Committee as appropriate.

The Consultant shall prepare a 10 minute version of the key findings and recommendations from the case study that is suitable to internally brief decision-makers within City of Welland.

### **7. Additional Requirements**

The Consultant will be required to sign a Confidentiality Agreement with the City of Welland to use the PIEVC Engineering Protocol, which is the intellectual property of Engineers Canada. This agreement covers non-disclosure to third parties or internal personnel who are not involved in the project.

Once the project is completed, the Consultant will be required to return the protocol to the City of Welland and destroy and not retain all electronic or hard copies.