Addressing Climate Change: A Municipal Roadmap to Adaptation and Resilience in the City of Welland, Ontario, Canada

Peter Nimmrichter (peter.nimmrichter@woodplc.com) (Wood plc, Burlington, Canada)
Rebecca Vanderbeck (rebcca.vanderbeck@woodplc.com) (Wood plc, Jacksonville, Florida, USA)
Christine Wissink (christine.wissink@woodplc.com) (Wood plc, London, England)
Marca Hagenstad (marca.hagenstad@woodplc.com) (Wood plc, Brussels, Belgium)

Background/Objectives. As the climate changes, cities across North America may experience more frequent and/or severe extreme weather, which will have significant social and financial consequences for city governments. Since 2012, the City of Welland, Ontario, with assistance from Wood plc, has been assessing potential climate change impacts, such as increased precipitation, and building resiliency into the City's stormwater/combined sewer systems and wastewater treatment plant. The principal objective of this work is to identify the components of the City's 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. Continued study has been founded on dynamic modelling of the major/minor stormwater systems contributing to a stormwater management facility in the City which already experiences performance issues. The objective of the modelling is to investigate how changing precipitation patterns in the future may exacerbate current problems, and specifically identify if more frequent surcharging events will manifest as more frequent at ground or on street flooding. The nature and relative levels of risk help to establish priorities for remedial action. The City has examined and implemented various infrastructure adaptation measures, notably to either "offset" the projected rainfall increases or to convey more runoff, in a framework of risk and uncertainty.

Approach/Activities. The assessment of vulnerability was based on the Engineers Canada Public Infrastructure Engineering Vulnerability Committee Climate Change Vulnerability Assessment Protocol while also updating local Intensity-Duration-Frequency information. Two time frames were targeted: 2020 and 2050. Wood assessments were supported with development of various integrated hydrologic-hydraulic model in PCSWMM.

Results/Lessons Learned. Recommendations from the vulnerability assessments and catalysed cost-benefit analysis include: 1) the implications (as related to performance and life cycle costing) of the application of the current or the projected IDF relationships be evaluated to determine long-term applicability for the storm sewer collection system design, operation and maintenance; and 2) the implications of a change from the current design standard, namely a 2-year design rainfall event, to a 5-year or a 10-year design rainfall event should be evaluated in the context of current sewer infrastructure capital plans, performance metrics and long-term sewer objectives. The assessment results suggested that adopting a 10-year design standard is possible with no significant additional financial impact when compared with a 5-year design standard for the 2050 IDF relationship. This holds true across both storm sewer network examples. A suite of remedial measures was also developed, including relief sewer systems outletting to the Welland Canal, watercourse improvements, and other operations and maintenance works. Capital budgeting and an implementation plan were also developed. The outcomes of the work have supported City staff to better manage infrastructure risks, by increasing the understanding of uncertainty related to infrastructure planning and design. In addition, this work is driving new thinking with regard to land use planning and stormwater management systems design, operation and maintenance in the City. In development is to update the City's engineering design standards to incorporate specific requirements for addressing climate change.