



REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE  
MEETING OF WEDNESDAY 29 JUNE 2011

**SUBJECT**      **TSUNAMI SIMULATION MODEL – CORE AREA WASTEWATER TREATMENT PROGRAM**

**ISSUE**

The proposed McLoughlin Point wastewater treatment plant is located at the entrance of the Victoria Harbour. There is a concern that this facility will be exposed to a tsunami caused by a Cascadia subduction zone earthquake.

**BACKGROUND**

The concept layouts for the proposed McLoughlin wastewater treatment plant (WWTP) show a finished ground elevation of 5 metres above sea level and a top of tank elevation of 8.9 metres. The concept layout includes the installation of critical mechanical, electrical and control components on top of the tanks above elevation 8.9 metres.

The Capital Regional District (CRD) has completed a preliminary analysis to assess the elevations outlined in the concept layouts. The technical publication "*Numerical Simulations of Tsunami Waves and Currents for Southern Vancouver Island from a Cascadia Megathrust Earthquake, 2007*" prepared with participation from the Institute of Ocean Sciences, Department of Fisheries and Oceans was used to complete the preliminary analysis.

[http://www.pac.dfo-mpo.gc.ca/science/publications/documents/PAG2007\\_Cherniawsky465.pdf](http://www.pac.dfo-mpo.gc.ca/science/publications/documents/PAG2007_Cherniawsky465.pdf)

The model simulation outlined in this publication predicts a wave height of about 2 metres for the McLoughlin Point area, not including wave run-up. Based on this information, the following represents the highest wave elevation that would be anticipated at McLoughlin Point:

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|--|---------|
| Tsunami wave height at McLoughlin Point  | 2.0 m** |
| High tide elevation above mean sea level | 1.8 m   |
| Storm surge                              | 1.0 m   |
| Rise in sea level                        | 1.0 m   |
| Wave run-up                              | 2.0 m** |
| Preliminary top of wave                  | 7.8 m   |

\*\* Requires localized model simulation to confirm

The initial assessment shows that the potential wave height of 7.8 metres is lower than the current concept layout with a top of tank elevation of 8.9 metres for the proposed McLoughlin Point WWTP. However, there is some uncertainty in the wave height and wave run-up height as the paper outlined above did not complete a detailed model simulation for the Victoria Harbour.

A detailed model simulation is required to more accurately predict the wave height and run-up at McLoughlin Point. The attached project proposal from Fisheries and Oceans Canada (Appendix A) outlines a work plan, schedule and costs for a joint project with the CRD to complete the additional model simulation for the Victoria and Esquimalt harbours.

**ALTERNATIVES**

That the Core Area Liquid Waste Management Committee;

- 1) Recommend approval of the proposed joint project with Fisheries and Oceans Canada to model the potential inundation and run-up in the Victoria and Esquimalt harbours at a cost of \$95,000.
- 2) Not approve the proposed joint project with Fisheries and Oceans Canada.

**IMPLICATIONS**

The results of this additional modeling will provide the CRD with more certainty to set the elevations at the proposed McLoughlin WWTP. This information would be available for procurement to establish critical elevations at McLoughlin Point.

The results of the proposed joint project would also provide valuable information to the CRD and the municipalities of Colwood, View Royal, Saanich, Esquimalt and Victoria for emergency response planning related to the impacts of a tsunami on the Victoria and Esquimalt harbours.

**CONCLUSION**

The concept layout for the proposed McLoughlin WWTP has taken into account the potential of a tsunami generated by a Cascadia subduction zone earthquake. However, there is some uncertainty in the wave height and run-up. A detailed model simulation for the Victoria and Esquimalt harbours as part of joint project with Fisheries and Oceans will provide more certainty in setting elevations for proposed facilities. The detail model simulation will also provide valuable information for the CRD and municipalities for emergency response planning as it relates to the impacts of a tsunami on the Victoria and Esquimalt harbours.

**RECOMMENDATION**

That the Core Area Liquid Waste Management Committee:

Recommend approval of the proposed joint project with Fisheries and Oceans Canada to model the potential inundation and run-up in the Victoria and Esquimalt harbours at a cost of \$95,000.

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Project Manager, Wastewater Treatment Project

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J.A. (Jack) Hull, MBA, PEng  
General Manager, Integrated Water Services  
Concurrence

TB:hr  
Attachment: 1

*Fisheries and Oceans Canada / Natural Resources Canada / The Capital Regional District  
Project Proposal: Potential tsunami inundation in Victoria and Esquimalt Harbours*

|   |   |
|---|---|
| Proposed Joint Project  | <b>Modeling of potential tsunami inundation and run-up in Victoria and Esquimalt Harbours</b>   |
| Project Duration and budget listing partner contributions (in kind) | Phase I: July – Dec. 2011; Phase II: Jan. 2012 – Mar. 2013<br>DFO (incl. CHS) 95k, PGC/NRCan 25k, CRD 95k   |
| Project Management  | <u>Principal Investigators:</u> J. Cherniawsky and R. Thomson, Fisheries & Oceans Canada<br><u>Co-Investigators:</u> D. Sinnott, P. Wills (DFO); K. Wang, T. James, J. Bednarski (NRCan); T. Brcic (CRD)  |
| Project objectives, phases and milestones                           | <p><u>The goal</u> of this project is to quantify potential tsunami hazards in terms of the tsunami wave run-up, inundation, basin resonances and strong currents that may be generated in Victoria and Esquimalt harbours by a future Magnitude 9.0 Cascadia subduction zone (CSZ) megathrust earthquake.</p> <p><u>Objectives:</u> (1) to assemble high-resolution digital bathymetry and land topography for Victoria Harbour, Esquimalt Harbour and surrounding waterways; (2) to generate a seamless high-resolution land-ocean grids for these two harbours, as well as for medium and low-resolution (larger-area) bathymetric grids for the tsunami model; (3) to carry out state-of-the-art numerical model experiments to estimate run-up and inundation under plausible CSZ earthquake scenarios, with a focus on tsunami wave impacts on potential locations of infrastructure projects; (4) to conduct analyses of existing sea level observations and use a numerical model to investigate harbour resonances and response to broad spectrum of incoming tsunami waves; (5) to examine existing records of seismically generated tsunamis impacting the west coast to determine the temporal and spatial attenuation of waves as they propagate eastward into Juan de Fuca Strait; of past observed and to compare these with numerical simulations; and (6) prepare manuscripts and high-quality figures for publication in peer-reviewed journals.</p> <p><u>Phases:</u> This project is divided into two phases. In Phase I (June – Dec. 2011) most of the data assembly, model grid formulation, and numerical simulation work will be undertaken to provide specific tsunami hazard information to CRD and harbour authorities needed for design of infrastructure projects. The remaining data processing, empirical along-strait wave attenuation estimation, and analyses will be carried out during Phase II (Jan. 2012 – Mar. 2013) to generate new results for publication in scientific journals.</p> <p><u>Milestones:</u> (1) assemble bathymetric and topographic data to generate model grids and prepare earthquake scenarios (Sep. 15, 2011); (2) carry-out numerical model experiments under various scenarios (Oct 30, 2011); (3) generate tsunami hazard maps for specific infrastructure sites (Nov. 20, 2011); (4) prepare a report about these results (Dec. 20, 2011);</p> |

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|                     | (5) assemble and process tide and bottom pressure data from historical tsunamis impacting the west coast and Juan de Fuca Strait (Feb. 28, 2012); (6) carry out additional model runs and detailed analyses about potential harbour resonances (Mar. 31, 2012); (7) prepare material for publications, write, revise and submit manuscripts for publication (March 31, 2013). |
| Expenditure details | <u>Budget</u> : 95 K from CRD; 120 K (in kind) from DFO and NRCAN<br><u>Expenditures</u> : Contractors 71.5K; publications 14K; overhead 9.5K   |