North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy: Summary of Methodology for Consequences on DNV.org/SeaLevelRise

The North Shore partners (District of North Vancouver, City of North Vancouver, District of West Vancouver, Squamish Nation, Port of Vancouver, and North Shore Emergency Management) retained Kerr Wood Leidal Associates Ltd. (Kerr Wood Leidal), a consulting engineering firm with expertise in risk assessment and water resource engineering, as technical consultants for the North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy.

Coastal Flood Consequence Assessment

Kerr Wood Leidal conducted a coastal flood consequence assessment, which includes the consequences illustrated on the webpage. The objective of the assessment was to estimate the potential impacts of sea level rise with coastal flooding scenarios in order to understand what the consequences of not undertaking sea level rise adaptation measures, i.e. a "do nothing" approach.

The assessment was completed to identify and quantify the consequences of coastal flooding under two future coastal stillwater scenarios if no adaptation measures are undertaken:

- 1 m sea level rise during a major storm, 10% annual probability stillwater level (10-year return period), and
- 2 m sea level rise during an extreme storm, 0.5% annual probability stillwater level (200-year return period).

The six consequence variables illustrated on the webpage exemplify some of the consequences, and methods used to estimate and assess the potential flood consequences are summarized in the following table.

Variables	Methodology
Number of residents that could experience flooding; Cost of building damage; Amount of building damage debris	Census-based consequence modelling using the Canadian version of the HAZUS model for population displacement, building and contents damage, and building and contents debris generation. The HAZUS model is commonly used for flood consequence assessments. It was originally developed in the United States by the Federal Emergency Management Agency and been adapted for Canada by Natural Resources Canada. HAZUS uses census data and algorithms to estimate expected damage from multiple hazards at the dissemination block scale. The model uses a comprehensive set of stage-damage functions (SDFs) to assess building damage.
Number of businesses that could experience flooding or power outage	Business disruption modelling based on work by Chang et al (2008)[1]. Business disruption was assessed in terms of the number of businesses of a given sector expected to experience temporary closure due to power outage and/or direct building damage induced by the flooding. Power outage assessment based on analysis of BC Hydro's substation network. Power outages were also assessed at the dissemination block spatial scale to show the general spatial variability. Kerr Wood Leidal worked with BC Hydro staff to develop conditions for estimating when a coastal flood would trigger a power outage either due to proactive measures to limit damage or unavoidable disruption of service at substations.
Area of parkland that could flood; Number of cultural and heritage places that could flood	Spatial identification of variables within the scenario flood extent using GIS. GIS-based spatial exposure analysis involved comparing flood extent maps to maps of sector variables to determine the number of exposed elements for each variable. Exposure to inundation as well as the combination of inundation and power outage was considered.

A technical report currently under preparation by Kerr Wood Leidal will provide additional information and documentation.

[1] Chang, S.E., Pasion, C., Tatebe, K, and Ahmad, R., 2008. Linking Lifeline Infrastructure Performance and Community Disaster Resilience: Models and Multi-Stakeholder Processes. Multidisciplinary Center for Earthquake Engineering Research (MCEER) Technical Report MCEER-08-0004. ISSN 1520-295X.