Capital Regional District

Coastal Sea Level Rise Risk Assessment

AECOM

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Executive Summary

1. **Project Context.** With global sea levels projected to continue rising, public and private assets and shoreline land uses across the Capital Regional District (CRD) have the potential to experience an increase in frequency and magnitude of periodic inundation events as well as permanent inundation. The Coastal Sea Level Rise Risk Assessment project has been developed as a first phase in CRD's multi-year project to gather information to support future analysis and policy response for sea level rise (SLR) within the CRD. CRD is the first BC regional district to have completed mapping based on the draft provincial guidelines for floodplain mapping and intends to use the mapping and findings from this project to consult and provide feedback to the Province on the proposed guidelines, and planning for the impacts that SLR will have in the CRD region. Mapping based on provincial guidelines shows that any significant impacts from sea level rise will not be felt until 2050 or beyond, and advanced planning can be applied to help avoid or manage such impacts before they are realised.

2. **Uses and Limitation.** This project is the very first step to assess how the region's shoreline may look 35, 85 and 185 years in the future. The mapping from this study considers static sea level rise, coupled with relatively extreme 1 in 500 year storm surge conditions, so while areas may be depicted within an inundation zone, this does not mean these areas will necessarily experience flooding due to sea level rise and storm surge in the future. Significant further analysis is necessary to fully understand what the effects of future sea level rise may be in these coastal areas. Establishing flood hazard boundaries is a responsibility of local government, and each municipality within the region will determine how they will respond to future sea level rise. Once future flood hazard area boundaries are established by municipalities, there are many tools that can be used to address sea level rise within these areas. These include planning and regulatory tools, land use change or restriction, structural tools including flood protection works, and non-structural tools such as soft armouring by wetland construction. Future work for specific locations should be used to confirm the data used and produced in this report.

3. **Project Objectives.** The primary purpose of this project was to identify and map areas that are vulnerable to SLR within the CRD. The secondary purpose was to understand the potential economic consequences of SLR, thereby providing information to support development of future policy and land use regulations. The technical scope of work to deliver these objectives was designed to align with the available project funding, and the mapping (Appendix A) and other data reporting (Appendix B) was focused on 24 key areas ("Sea Level Rise Focus Areas") that were selected because of the relatively high levels of expected future inundation and / or the key community assets that are present in those areas. Three high-level case studies were developed to help identify the potential service disruption effects that could occur under sea level rise and storm surge conditions. These case studies were for transportation disruption (based on disruption to Highway 14 south of Shirley), local community disruption (in the Oak Bay Windsor Park residential area), and business disruption (in the Victoria Inner Harbour).

4. **Approach to Mapping.** The maps developed for the project show the anticipated future shoreline at high tide, and during storm surge conditions in 2050, 2100 and 2200. The mapping is based on the 2011 Province of BC Coastal Floodplain Mapping Guidelines and Specifications Report, and uses the recommended SLR levels for those time periods and 1 in 500 year storm surge conditions. A digital elevation model was developed for across the region, and then factors that will influence future sea levels were layered onto the model to give an estimation of the future shoreline. These factors include projections for static SLR, highest high water large tide (HHWLT) values collected from hydrological monitoring at over 30 sites across the region, vertical land elevation figures which address seismic activity, and the 1 in 500 year storm surge conditions.

5. **SLR Focus Areas.** Once maps were developed for the entire CRD coastline a workshop was run with the CRD Project Team to identify the key assets (e.g. key municipal infrastructure) that exist within the coastal areas that could be subject to flooding for the scenarios considered. This was used to help define SLR Focus Areas for a selection of areas with key assets and relatively high levels of expected future inundation. A set of 24 SLR Focus Areas were then defined and for each area maps were produced to show inundation levels for the different sea level rise scenarios (for 2050, 2100 and 2200, and with and without 1 in 500 year storm surge conditions).

6. **Description of land and assets within each SLR Focus Area.** Data were compiled to define land use, shoreline sensitivity to sea level rise, valuation of land and improvements, roads and presence of key public assets within the areas that would be flooded within the selected scenario of SLR in year 2100 plus the 1 in 500 year storm surge conditions. These data were provided by CRD and included: municipal zoning data, BC Assessment data for actual use of land and market valuation of land and improvements, location of roads, and replacement cost estimates for key public assets. These data are reported in Appendix B and help describe the assets that would theoretically be at risk for the selected scenario if the 1 in 500 storm surge scenario occurs and assuming no management measures were put in place.

7. **Key Findings and Recommendations.**
   a. As a result of varying topography there are different levels of inundation that may occur across the CRD coastline for the SLR and storm surge scenarios that were considered as part of this project. Many of the lower lying areas that may have higher levels of inundation coincide with developed and populated areas, leading to the potential for infrastructure damage, safety risk and service disruption. As well as the key areas represented in the 24 SLR Focus Areas, there are other parts of the CRD outside of these selected areas that could have inundation effects under these scenarios and these areas should also be considered during future mapping and planning work.
   b. For the 24 Focus Areas used for this project the total valuation of land and improvements (as defined by BC Assessment) within the year 2100 + 500-year storm surge inundation line ranges from $330 million (for the Oak Bay Windsor Park SLR Focus Area) to $3.4 million (Albert Head SLR Focus Area). These are total asset values based on market valuation and do not infer expected losses that would occur from periodic inundation. Across the 24 SLR Focus Areas, BC Assessment data show that residential property has the highest total assessed value followed by commercial and then civic, institutional and recreational land uses.
   c. The key assets that would be at least partially inundated for this selected scenario (and assuming no future management measures are put in place) within the 24 SLR Focus Areas are principally network structures for water and wastewater, and some road bridges could be affected. There is the potential for some large businesses to be at least partially inundated, with some of their operations (e.g. ferry, float plane) being regionally important for the tourism sector. There are also a large number of marine docks that are within the inundation line for this scenario, though it has not been assumed that infrastructure damage would necessarily occur to the dock structures themselves.
   d. One of the main areas of Highway inundation for the year 2100 plus 1 in 500-year storm surge scenario is at Highway 14 between Sooke and Port Renfrew, and this area was used as a case study for transport service disruption. In other SLR Focus Areas there are a range of local and connector roads that would be subject to inundation for this scenario.
   e. The key recommendation is that CRD use the analysis and mapping conducted for the 24 SLR Focus Areas as an evidence base for the identification and appraisal of options for a future model bylaw that deals with SLR management for the CRD. In particular, the data reported in this project demonstrates the types of land use, key assets, services and indicative economic values that exist in areas at inundation risk, and this evidence will help to develop the objectives for and assess the impacts of different management options.

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1. Introduction

1.1 Background

Historically, the main causes of coastal flooding are attributed to astronomical tides coupled with the meteorological influences associated with storms (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). With global sea levels projected to continue rising, public and private assets along with land uses in shoreline areas across the Capital Regional District (CRD) have the potential to experience an increase in frequency and magnitude of periodic inundation events as well as permanent inundation. Therefore, incorporation of future flood hazard impacts into development of coastal hazard maps can provide science-based support to allow prioritization of resource allocation to best prepare coastal communities, fragile ecosystems, and jeopardized infrastructure.

Within the Province of British Columbia (BC), local governments have responsibility for making decisions about local floodplain management practices, including decisions about floodplain bylaws (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). The CRD is planning a series of work that will contribute to the development of a model bylaw for managing the impact of sea level rise (SLR). Such a bylaw is one of the regulatory adaptation strategies that can be put into place at the local level (BC Ministry of Environment, 2013).

In 2011 the Province of BC issued guidelines and specifications for the development of floodplain maps to show coastal hazard, including from SLR (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). This project is the first application of these guidelines by the CRD for the purposes of understanding coastal SLR risk at the regional level.

The Coastal Sea Level Rise Risk Assessment project has been developed as a first phase in CRD's multi-year project to gather information to support future analysis and policy response for sea level rise (SLR) within the CRD. CRD is the first BC regional district to have completed mapping based on the draft provincial guidelines for floodplain mapping and intends to use the mapping and findings from this project to consult and provide feedback to the Province on the proposed guidelines, and planning for the impacts that SLR will have in the CRD region. The mapping based on provincial guidelines show that any significant impacts from sea level rise will not be felt until 2050 or beyond, and advanced planning can be applied to help avoid or manage such impacts before they are realised.

1.2 Project Objectives

The primary purpose of this project was to identify and map areas that are vulnerable to SLR within the CRD. The secondary purpose was to conduct a risk assessment to understand the potential economic consequences of SLR, thereby providing information to support development of future policy and land use regulations.

The specific objectives of this project were:

1. To map future limits and depth of inundation in the CRD study area for multiple climate change planning scenarios with Higher High Water Large Tide (HHWLT; the average annual high tide) and extreme high tide (HHWLT plus storm surge).
2. To identify the different land uses that exist within areas that may be subject to future inundation.
3. To identify the total value of land, developments and infrastructure that exist within areas that may be subject to future inundation.
4. To identify the key public assets that exist within areas that may be subject to future inundation.

5. To provide an evidence base of the above maps and data that can be used by CRD and regional municipalities / electoral areas for future development of a model bylaw.

The technical scope of work to deliver these objectives was designed to align with the available project funding and the geographic context of the CRD region, with extensive shoreline on the mainland portion of Vancouver Island as well as many islands, with varying shoreline topography and land uses. The analysis and mapping for the project was focused on a series of key areas that were selected because of the relatively high levels of expected future inundation and / or the key community assets that are present in those areas (see section 2.4). The digital files developed by the project and delivered to CRD give expected inundation profiles for the whole of the CRD coastline and can be used by CRD to replicate this scope of work for those areas that were not included in the areas covered by this project.

1.3 Project deliverables

The deliverables from this project are:

- This project report as a written record of the project.
- A separate map book showing spatial inundation information for the key areas that were analysed as part of the project.
- Digital files that provide inundation levels for the different planning scenarios for the entire CRD coastline.

1.4 Report Outline

This report is structured with the following sections:

- Method – a summary of the technical approaches used to achieve the project objectives.
- Results – a summary of the maps and other data generated from the project.
- Conclusions – a summary of the key findings identified from the project.
- Recommendations – a listing of next steps and further work that could be done by CRD to implement these findings in the context of model bylaw development.
- Appendix A – map book showing inundation levels for different scenarios (provided as separate documents)
- Appendix B – detailed land use and valuation statistics for each focus area.
- Appendix C – detailed methods used for service disruption case studies.
- Appendix D – listing of referenced data sources used in the project.

1.5 Uses and Limitations

This project is the very first step to assess how the region's shoreline may look 35, 85 and 185 years in the future. The mapping from this study considers static sea level rise, coupled with relatively extreme 1 in 500 year storm surge conditions, so while areas may be depicted within an inundation zone, this does not mean these areas will necessarily experience flooding due to sea level rise in the future. Significant further analysis is necessary to fully understand what the effects of future sea level rise may be in these coastal areas. Establishing flood hazard boundaries is a responsibility of local government, and each municipality within the region will determine how they will respond to future sea level rise. Once future flood hazard area boundaries are established by municipalities, there are many tools that can be used to address sea level rise within these areas. These include planning and regulatory tools, land use change or restriction, structural tools including flood protection works, and non-structural tools such as soft armouring by wetland construction. Future work for specific locations should be used to confirm the data used and produced in this report.

1.6 Acknowledgements

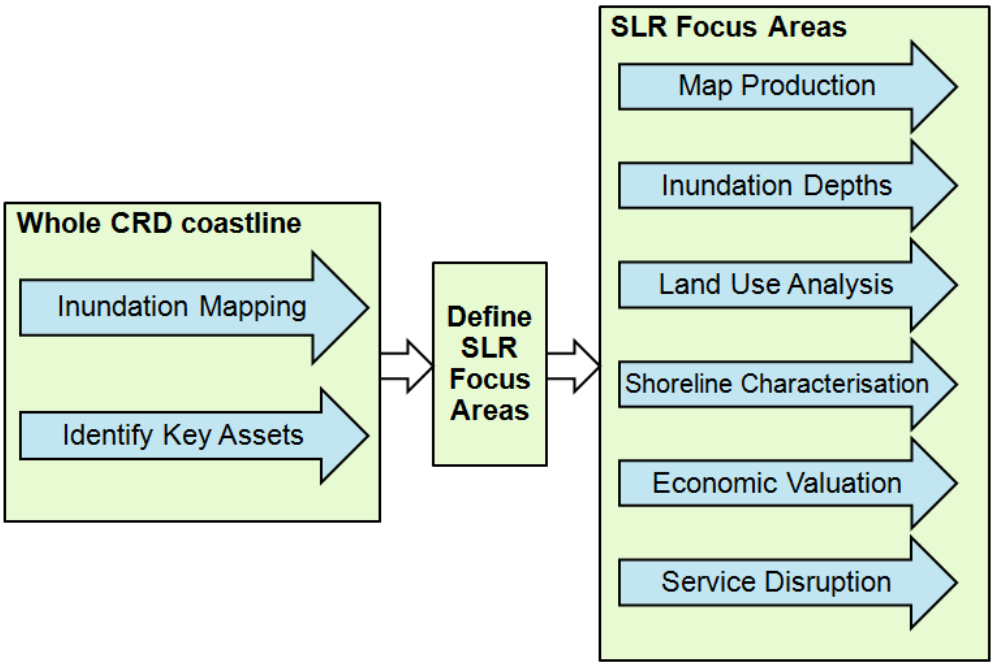
This project was made possible with financial support from Natural Resources Canada's Climate Change Impacts and Adaptation Program, Tides Canada, City of Victoria, District of Saanich, and the Capital Regional District, with additional support from the Province of British Columbia Climate Action Secretariat.

2. Methods

2.1 Overview

This project included a number of related tasks that were used to develop mapping, followed by the selection of SLR Focus Areas, and then data compilation and analysis for those SLR Focus Areas. These tasks are outlined in Figure 1 and described in the following sub-sections.

Figure 1 - Overview of project tasks



2.2 Inundation Mapping

Analyses were conducted to determine appropriate inundation water levels under future SLR projections following the methods outlined in the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Coastal Floodplain Mapping Guidelines and Specifications (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). The sections below present a summary of:

- The existing and future conditions water level analysis for the CRD study area, and
- The methods to produce SLR inundation mapping associated with each of the planning time horizons.

2.2.1 Water Level Analysis

The general approach for the water level analysis is to first characterize the existing conditions of the hydrodynamic tidal environment. Two reference water levels were selected for inundation mapping purposes: the HHWLT (average annual high tide) and an extreme high tide (HHWLT plus storm surge). The present-day HHWLT values were determined through examination of published tide data tables (Section 2.2.2). Existing conditions were then projected into the future by adding the specified amount of SLR for each climate change scenario, including the effects of storm surge for the extreme high tide case (Section 2.2.3).

2.2.2 Existing Conditions Water Levels

The Canadian Hydrographic Service (CHS), tasked with maintaining Canada's network of tide gauge instruments, collects and publishes HHWLT elevations for approximately 40 Reference Stations and Secondary Stations for the CRD study area in a series of Tide Table Volumes. The HHWLT is the average of the annual maximum higher high water levels from approximately 19 years of predicted tide data and represents the average annual high tide level. HHWLT and mean water level (MWL) values were obtained from Volume 5 of the Canadian Tide and Current Tables. Data values are recorded relative to each station's local Chart Datum (CD), which typically corresponds to the lowest recorded low tide value. Since each station's CD is different, it was necessary to convert all water levels to a common vertical datum to facilitate consistent inundation mapping across the region. Conversion to Canada's national datum, the Canadian Geodetic Vertical Datum of 1928 (CGVD28), was achieved by assuming the local MWL datum is approximately equal to the CGVD28 datum at each tide station (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). This approximate conversion technique is supported by comparing the CD to MWL conversion factor derived from the tide tables to the vertical offset of HHWLT and CD elevations obtained from 24-hour benchmark occupations of two tidal stations as shown in Table 1. HHWLT values relative to CD were converted to CGVD28 using the MWL offsets at each tide station (Table 2).

Table 1 - Comparison of Conversion Techniques from Local CD to CGVD28

Tidal Station	CD to CGVD28 conversion based on 24-hr benchmark occupation	CD to CGVD28 conversion based on CD-MWL difference
Patricia Bay	2.26 m	2.26 m
Victoria	1.89 m	1.90 m

Source: Personal communication with Canadian Hydrographic Service.

Table 2 - Tidal Datums for CRD Study Area Tide Stations

Station	Latitude (deg)	Longitude (deg)	HHWLT (m CD)	MWL (m CD)	HHWLT (m CGVD28)
Port Renfrew	48.55	-124.417	3.8	1.9	1.9
Sooke	48.367	-123.733	3.6	1.9	1.7
Victoria	48.417	-123.367	3.4	1.9	1.5
Fulford Harbour	48.767	-123.45	3.8	2.3	1.5
Point No Point	48.4	-123.967	3.63	1.92	1.71
Sooke Basin	48.383	-123.683	3.32	1.83	1.50
Becher Bay	48.333	-123.633	3.41	1.77	1.65
Pedder Bay	48.333	-123.55	3.35	1.83	1.52
William Head	48.333	-123.533	3.26	1.77	1.49
Esquimalt	48.433	-123.433	3.38	1.89	1.49
Clover Point	48.4	-123.35	3.41	1.89	1.52
Oak Bay	48.433	-123.3	3.54	2.01	1.52
Finnerty Cove	48.467	-123.3	3.44	1.98	1.46

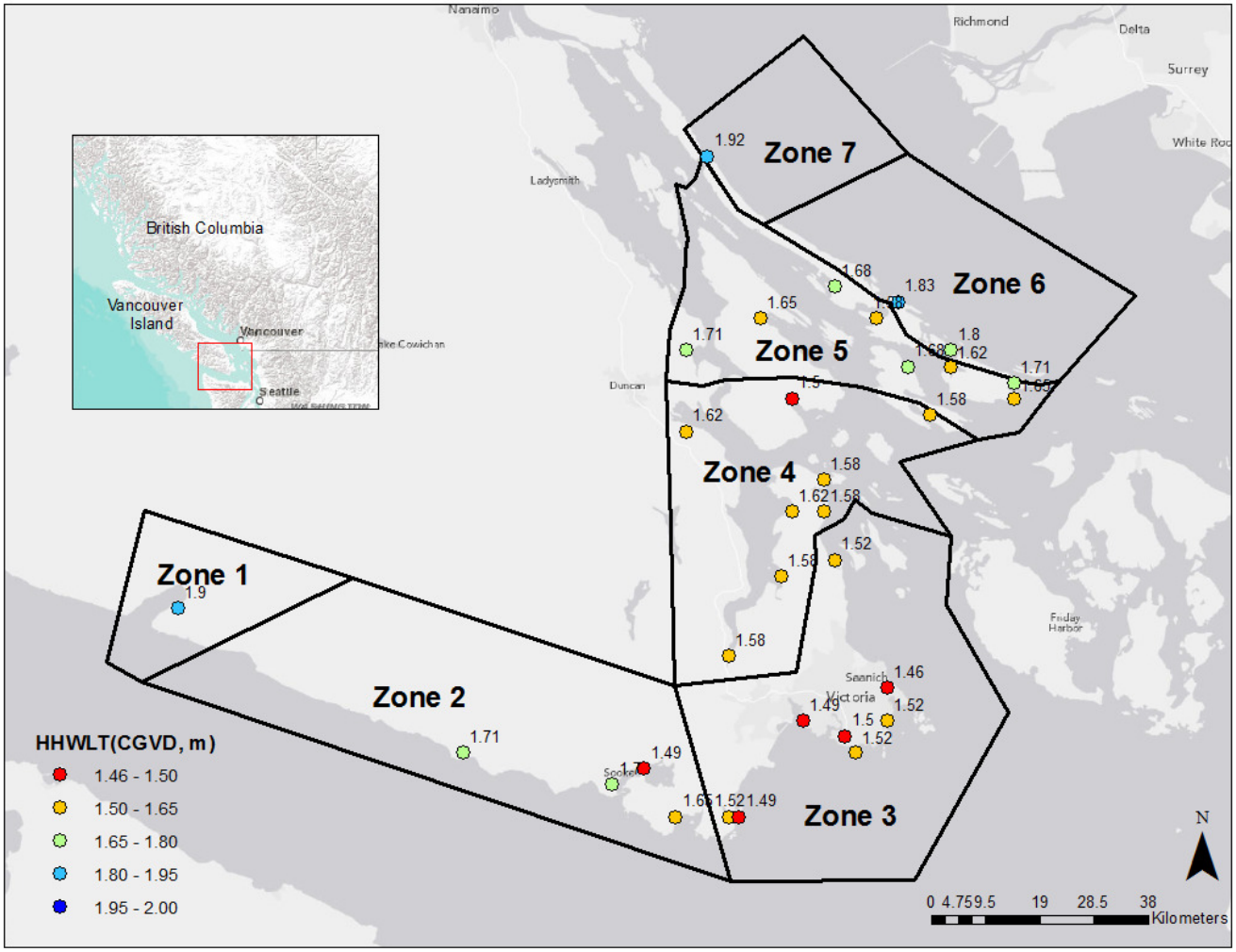
Station	Latitude (deg)	Longitude (deg)	HHWLT (m CD)	MWL (m CD)	HHWLT (m CGVD28)
Saanichton Bay	48.6	-123.383	3.72	2.20	1.52
Sidney	48.65	-123.4	3.63	2.04	1.59
Swartz Bay	48.683	-123.4	3.84	2.26	1.59
Patricia Bay	48.65	-123.45	3.87	2.26	1.62
Brentwood Bay	48.583	-123.467	3.84	2.26	1.59
Finlayson Arm	48.5	-123.55	3.84	2.26	1.59
Cowichan Bay	48.733	-123.617	4.0	2.38	1.62
Maple Bay	48.817	-123.617	4.30	2.59	1.71
Narvaez Bay	48.767	-123.1	4.0	2.35	1.65
Bedwell Harbour	48.75	-123.233	3.84	2.26	1.59
Hope Bay	48.8	-123.267	4.02	2.35	1.68
Samuel Island South	48.8	-123.2	3.99	2.38	1.62
Ganges Harbour	48.85	-123.5	3.96	2.32	1.65
Village Bay	48.85	-123.317	3.90	2.32	1.59
Montague Harbour	48.883	-123.383	4.21	2.53	1.68
Porlier Pass	49.017	-123.583	4.51	2.59	1.92
Crofton	49.867	-123.65	4.21	2.47	1.74
Tumbo Channel	48.783	-123.1	4.30	2.59	1.71
Samuel Island North	48.817	-123.2	4.42	2.62	1.80
Georgina Point	48.867	-123.283	4.51	2.68f	1.83

Source: Canadian Hydrographic Service Tide and Current Tables (Volume 5)

Once converted to the CGVD28 datum, the HHWLT values for each station were mapped to qualitatively evaluate spatial trends in tidal characteristics (Figure 2). Within the CRD study area, values of HHWLT ranged from 1.46 to 2.0 meters; however, HHWLT levels were found to vary systematically and are relatively consistent over spatial scales of tens of kilometers. To capture spatial variability of the observed HHWLT, while also simplifying the inundation mapping, the CRD study area was divided into seven distinct 'Hydrographic Zones' based on similar values of HHWLT (Figure 2).

All coastal waters located within each zone were assigned a representative HHWLT value based on the average of the local HHWLT values at each station encompassed by the zone boundaries. Representative HHWLT values associated with each zone are presented in Section 2.2.3.5.

Figure 2 - Spatial Variability of HHWLT and Hydrographic Zones in CRD Study Area



2.2.3 Future Conditions Water Level Analysis

Once the existing conditions water levels were determined, they were projected to future conditions by adjusting for SLR. The sections below describe the SLR and storm surge scenarios examined to develop the future conditions water levels for inundation mapping.

2.2.3.1 Sea Level Rise

Based on guidance from the MFLNRO Coastal Floodplain Mapping Guidelines and Specifications, the following SLR scenarios were developed for the inundation mapping in the CRD study area:

- 0.5 m increase by 2050.
- 1.0 m increase by 2100.
- 2.0 m increase by 2200.

Regional adjustments based on local vertical land movements were applied to reflect the influence of subsidence and uplift on future SLR conditions at a local scale. Representative rates of ground movement for each Hydrographic

Zone were derived from information presented in the Coastal Floodplain Mapping Guidelines and Specifications and are displayed in Table 3 for the years 2050, 2100, and 2200. For each SLR scenario, the global rates presented above were adjusted to account for the amount of local vertical land movement shown in the table.

Vertical land movements presented in Table 3 consider long-term geological processes occurring over millennia. It should be noted that shorter-term processes, such as rapid subsidence or uplift as a result of a major earthquake, could result in significant changes in ground elevations, thereby warranting the re-evaluation of potential inundation impacts.

Table 3 - Vertical Land Movement for Each Hydrographic Zone in CRD Study Area

		Vertical Land Movement		
Zone	**Rate (mm/year)**	**2050 (m)**	**2100 (m)**	**2200 (m)**
1	-0.4	-0.02	-0.04	-0.08
2	3.1	0.155	0.31	0.62
3	1.1	0.055	0.11	0.22
4	1.1	0.055	0.11	0.22
5	1.1	0.055	0.11	0.22
6	1.1	0.055	0.11	0.22
7	1.1	0.055	0.11	0.22

Note: Positive values indicate zones of uplift and negative values indicate zones of subsidence.

2.2.3.2 Storm Surge

Taking into account the influence of storms on coastal water levels, the MFLNRO Coastal Floodplain Mapping Guidelines and Specifications provides recommendations for incorporating appropriate storm surge scenarios in the determination of design water levels. For highly developed areas of British Columbia such as Victoria, a 500-year (0.2-percent annual chance) magnitude storm surge of 1.3 m is recommended based on work by Ausensco Sandwell (2011a, b). This amount of storm surge was added to the future HHWLT water level to obtain an additional set of extreme tide scenarios considering the influence of storm events on coastal inundation.

2.2.3.3 Wave effects

The presence of breaking wave conditions may further increase the depth of water near the shoreline and will result in wave runup, potentially resulting in erosion and flooding. The extent of flooding will depend on terrain located landward of the shoreline. Wave effects were not included in the analysis, but the MFLNRO Coastal Floodplain Mapping Guidelines provides recommendations for estimating an allowance for wave effects.

2.2.3.4 Freeboard

A nominal freeboard is typically added to the FCL to provide an additional factor of safety, accounting for uncertainties associated with the estimation of the design water level (e.g. 500-year storm surge). The inundation analysis did not take into account freeboard of 0.6 m as noted in the MFLNRO Coastal Floodplain Mapping Guidelines. For the identification of impacts, neglecting freeboard is appropriate, as the inclusion of freeboard in the inundation itself would bias the inundation depths. The SLR scenarios selected for mapping are at the high end of the uncertainty range of the current SLR projections therefore neglecting freeboard for determining inundation depth

and impacts is appropriate. However, when developing the model bylaws, the inclusion of freeboard would be appropriate, as noted in the Guidelines.

2.2.3.5 Inundation Mapping Scenarios

Six inundation scenarios were evaluated as a part of the SLR assessment for the CRD (Table 4). Each SLR scenario – 0.5 m by 2050, 1.0 m by 2100, and 2.0 m by 2200 – was evaluated under two tide conditions: inundation associated with 1) HHWLT (average annual high tide) and 2) extreme high tide (HHWLT plus storm surge).

Table 4 - Future Projections of HHWLT and Extreme High Tide for the CRD Study Area

	Estimated Future HHWLT (including vertical land movement and sea level rise) (m CGVD28)				Estimated Future Extreme High Tide (including vertical land movement and sea level rise) (m CGVD28)			
Zone	**Existing**	**2050**	**2100**	**2200**	**Existing**	**2050**	**2100**	**2200**
1	1.9	2.42	2.94	3.98	3.2	3.72	4.24	5.28
2	1.7	2.05	2.39	3.08	3.0	3.35	3.69	4.38
3	1.5	1.95	2.39	3.28	2.8	3.25	3.69	4.58
4	1.6	2.05	2.49	3.38	2.9	3.35	3.79	4.68
5	1.7	2.15	2.59	3.48	3.0	3.45	3.89	4.78
6	1.8	2.25	2.69	3.58	3.1	3.55	3.99	4.88
7	1.9	2.35	2.79	3.68	3.2	3.65	4.09	4.98

*Note 1: Future water levels include global SLR projections with local adjustments for vertical land motion at 2050, 2100, and 2200, as described in Section 2.2.3.1 (Table 3). Allowance for regional uplift or subsidence for each time period was calculated using vertical land movement values taken from Table 3. The formula is as follows: Allowance for Regional Uplift or Subsidence = Vertical Land Movement x (-1). Example calculation: Zone 1 (2050) = Existing HHWLT (1.9 m) + Subsidence (-0.02 * -1) + Sea Level Rise (0.50 m) = 2.42 m. Subsidence values increase the amount of relative sea level rise; uplift values decrease the amount of relative sea level rise. The extreme tide scenarios include a 500-year storm surge magnitude of 1.3 m..*
Note 2: The Canadian Hydrographic Service is in the process of updating local luni-tidal based HHWLT estimates, which are consistent with provincial sea level rise mapping guidelines and used in this study, to values established using a new datum calculator program."

2.2.4 Inundation Map Development

Once the relevant water level statistics were generated for the six inundation mapping scenarios, the inundation maps were generated utilizing methodologies developed by the NOAA Coastal Services Center (Marcy et al., 2011).

2.2.4.1 Topographic Data

AECOM used topographic and bathymetric data provided by the CRD and public sources to develop a 1-meter resolution seamless topographic-bathymetric Digital Elevation Model (DEM). This dataset was leveraged from the DEM created for the CRD Modelling of Potential Tsunami Inundation Limits and Run-up study (AECOM, 2013). The DEM forms a single, bare earth surface that extends from open water up to a specified interior land surface elevation. An interior contour elevation of 10 m CGVD28 was used as the upland cutoff. Although more recent 2013 LiDAR data was available from the CRD, a digital elevation model could not be created from this LiDAR data within the timeframe and budget for this project. The 2013 LiDAR was used to spot check elevation data within the sea level rise focus areas.

2.2.4.2 Water Surface DEM Creation

The initial step in creating the inundation maps was to create the inundated water surface, or DEM. Projected SLR and storm surge were added to the tide scenarios to develop the tidal water surface over the open water portion of the CRD study area for each of the six inundation scenarios.

The water surface DEM was extended inland to project the water surface over the inundated topography. It should be noted that the water surface DEM is simply an extension of the tidal water surface at the shoreline over the inland topography. This represents a generalized estimate of the inland inundated water surface. This step does not take into account the associated physics of overland flow, wave dissipation, levee overtopping, or potential shoreline erosion associated with extreme water levels and waves. In order to account for these processes, a more sophisticated modelling effort would be required.

2.2.4.3 Inundation Depths

Depth and extent of flooding raster files were created by subtracting the land-surface DEM from the water surface DEM. Both DEMs were generated using a 2-meter horizontal resolution with the same grid spacing in order to allow for grid cell-to-grid cell subtraction. The resultant DEM provides both the inland extent and depth of inundation (in the absence of considering hydraulic connectivity).

The final step in creating depth and extent of flood maps relies on an assessment of hydraulic connectivity. The methodology described by Marcy et al. (2011) employs two rules for assessing whether or not a grid cell is inundated. A cell must be below the scenario water level, and it must be connected to an adjacent grid cell that was either flooded or open water. NOAA's methodology applies an "eight-sided rule" for connectedness, where the grid cell is considered "connected" if any of its cardinal or diagonal directions are connected to a flooded grid cell. This approach decreases the inundated area over earlier inundation methods that considered a grid cell to be inundated solely based on its elevation (i.e., all grid cells with elevation below the reference water level were shown as inundated, even if they were separated from the flood source by topographic high ground).

The assessment of hydraulic connectivity removes areas from the inundation zone if they are protected by levees or other topographic features that are not overtopped. It also removes areas that are low-lying, but inland, and not connected to an adjacent flooded area.

2.2.4.4 Inundation Mapping Caveats

The Provincial Coastal Floodplain Mapping Guidelines and Specification document provides the following notations for use with floodplain maps:

- Under the provisions of the Flood Hazard Statutes Amendment Act, 2003 (Bill 56), local governments have the role and responsibility for making decisions about local floodplain development practices, including decisions about floodplain bylaws within their communities. Information on floodplain management guidelines can be found in the BC Flood Hazard Area Land Use Management Guidelines.
- Users must note the dates of base mapping, aerial photography, ground or bathymetric surveys and issue of mapping relevant to dates of development in the map area. Subsequent developments or changes within the floodplain or channel will affect flood levels and render site-specific map information obsolete.
- The accuracy of the location of a floodplain boundary as shown on this map is limited by the base topography. It is generally assumed to be plus or minus one-half the increment of the ground contours.

- The floodplain limits are not established on the ground by legal survey. A site survey is required to reconcile property location, ground elevations and designated flood level information. Building and floodproofing elevations should be based on field survey and established benchmarks.
- Flooding may still occur outside the defined floodplain boundary and the local government does not assume any liability by reason of the failure to delineate flood areas on this map.
- The required or recommended setback of buildings from the natural boundaries of watercourses to allow for the passage of floodwaters and possible bank erosion is not shown. This information is available from the local government. In addition, site-specific setbacks from the floodplain limit must be considered.
- Flood construction level is based on a global sea level rise described in Section 2.2.3.1. This may need to be revised to reflect updated future sea level rise values.

2.3 Identification of key assets

2.3.1 Use of Key Assets

This project used the identification of important shoreline assets in order to:

- Develop SLR Focus Areas that provide coverage across areas containing important assets (see section 2.4).
- Develop a shortlist of public assets for which valuation data would be compiled (see section 2.9).

The definition of Key Assets used for this project was:

Physical infrastructure and buildings that provide important services to the community. Key Assets include:

- *Transportation assets such as transportation infrastructure (rail lines, airports, highways),*
- *Utility Asset such as utility infrastructure (water and wastewater treatment plants, power plants and their key transmission and distribution lines),*
- *Community Assets such as public health and safety facilities (hospitals, police and fire stations).*
- *Business assets such as major employers, such as schools, universities, government, and large businesses.*

This definition was used as the basis for compiling relevant data provided by CRD (see section 2.3.2) and for eliciting input and review from regional municipalities / electoral areas through a workshop (see section 2.3.3).

The Key Assets identified for each of the SLR Focus Areas are reported in Appendix B and summarised in Table 11.

2.3.2 Spatial data

The following spatial data were used to develop a preliminary list of Key Assets:

- BC Assessment Actual Use Codes with values higher than 610. These codes correspond to non-residential parcels of land that may have important institutional, commercial or utility assets.
- CRD stormwater and sanitary key assets database – key structures layer.
- CRD water assets database – data layers for network structures, water structures and containment structures.
- CRD Atlas Civic Sites layer.

A 6 metre contour line was used as a conservative approximation of potential SLR and storm surge scenarios[1], and the assets shown by these spatial data layers that were within this 6 metre contour were identified. The definition of Key Asset (section 2.3.1) was used to shortlist those assets that would be classified as Key Assets.

2.3.3 Workshop

A workshop with representatives from regional municipalities and electoral areas was conducted with the objective of reviewing the preliminary set of Key Assets and gaining participant review of this list and suggested additions to the list. In advance of the meeting the participants were asked to identify the Key Assets that exist in shoreline areas of their respective municipalities and electoral areas. The definition of Key Assets and a list of specific asset types was sent to participants to help them identify assets in advance of the meeting.

The workshop was facilitated by using ArcGIS software to take participants through all coastal areas of the CRD, showing the locations of the Key Assets included in the preliminary list, and asking participants to identify other Key Assets that had not been recorded in the preliminary list.

2.4 Definition of Sea Level Rise Focus Areas

This project was concentrated on the mapping and analysis of a series of SLR Focus Areas that had relatively high levels of future inundation and / or with key community assets present in areas that would be inundated. There was also a preference to include SLR Focus Areas for a range of the regional municipalities / electoral areas. SLR Focus Areas were defined based on a set of guiding principles, rather than strict, rule-based criteria that had to be adhered to in all cases. This approach recognised that there were trade-offs and subjective judgements to make in achieving the inclusion of a range of representative areas while also having an objective and transparent basis for SLR Focus Area definition.

The selected principles for guiding the selection of SLR Focus Areas were:

1. Each SLR Focus Area should be defined to:
    a) Contain one or a small number of different types of land use. This helps avoid having significant mixes of urban / rural and developed / undeveloped land within each SLR Focus Area.
    b) Contain areas with similar topography. This helps ensure that the summary data for each SLR Focus Area are representative, rather than masking a high level of variability in the level of inundation that occurs across the shoreline of the area.
    c) Contain at least one key asset that is highly important locally or regionally. This helps ensure that the selected areas are of importance in relation to potential risks from SLR.
    d) Avoid crossing municipal / electoral area boundaries. Where candidate SLR Focus Areas cross a boundary separate SLR Focus Areas should be developed for each municipality or electoral area. This division will help support future use of these SLR Focus Areas for consideration in bylaw development at the individual municipality or electoral area level.
2. The land-ward limit of each SLR Focus Area will be the Floodplain Limit for the selected Scenario of 2100 + 500-year storm surge. This land-ward limit is defined as per Figure 2-4 of the Provincial Coastal Floodplain Mapping Guidelines and Specifications (BC Ministry of Forests, Lands and Natural Resource Operations, 2011). Lateral limits were also defined for the SLR Focus Areas in order to allow separate areas to be defined and be subject to the land use and economic analysis conducted for this project. The selected scenario of 2100 + 500-year storm surge was proposed to and accepted by CRD for use in the land use and economic

[1] *A basic scenario was used for this task as it was undertaken prior to completion of the inundation mapping for different SLR and storm surge scenarios.*

analysis on the basis that it is a time horizon that would include identifiable SLR effects, and uses the storm surge period recommended by the provincial guidelines. The maps in Appendix A for this scenario show the lateral limits (marked as the 'Economic Impact Analysis Area') that define each SLR Focus Area for use in the land use and economic analysis described in sections 2.5 to 2.9.

3. The set of selected SLR Focus Areas should:
   a) Include at least one SLR Focus Area for each regional municipality / electoral area that would experience coastal effects from SLR.
   b) Include SLR Focus Areas for a broadly representative variety of different land uses, critical assets and stages of development.

2.5 Land Use Analysis

The existing land use and key infrastructure present within each SLR Focus Area were identified for those areas within the 2100 + 500-year storm surge scenario inundation line. This inundation line was developed through the mapping described in section 2.2.4, and includes all land that would be flooded for the 2100 + 500-year storm surge scenario. Land use and key infrastructure were identified through the use of six different sets of data analysis:

- **Recorded actual use.** As part of the property assessment system, BC Assessment provides a record of actual uses for each parcel of land. There are over 200 categories of actual use, with each parcel of land being assigned one of these categories. BC Assessment actual use data for 2013 were spatially linked to each parcel registered in the CRD's cadastral data layer. The total area of different actual use categories was calculated and is provided in tabulated form for each SLR Focus Area in Appendix B. These data provide an indication of the *current* uses of land at a relatively fine resolution.
- **Zoning.** Each municipality and electoral area defines different zoning types for land within their areas. The total area of land for each zoning type was calculated for each SLR Focus Area and is provided in tabulated form for each SLR Focus Area in Appendix B. These data provide an indication of the *permitted* uses of land at a relatively coarse resolution.
- **First Nation Reserves.** Spatial data for First Nations reserve land was used to identify the presence of any reserves within each SLR Focus Area. Where a reserve is present the area of that reserve within the inundation line is given for each SLR Focus Area in Appendix B.
- **Road and rail.** CRD spatial data sets were used to identify the presence and length of road and rail within the inundation line for each SLR Focus Area. Attribute data were used to allow a breakdown of road distances by different categories of road type and number of lanes. Data are reported for each SLR Focus Area in Appendix B.
- **Major pipeline and transmission line.** Spatial datasets were used to identify the length of any key pipelines or major electric transmission lines present within the inundation line for each SLR Focus Area. The presence of any key part of the major pipeline and transmission systems are reported for each SLR Focus Area in Appendix B. Local pipeline and transmission systems (i.e. to localised areas for domestic distribution) were not reported as key assets.
- **Bridges.** Bridge elevation data were provided by CRD for selected bridges within regional coastal areas. From this list of selected bridges, those that would be inundated within each SLR Focus Area for the selected 2100 + 500-year storm surge scenario are identified in Appendix B. Due to limitations in data accuracy for elevation of bridge structures, the bridge features shown in Appendix A maps should not be relied upon to determine if bridges would be inundated for the selected scenarios. If required for planning, site-specific analysis should be undertaken to determine the precise extent or level of inundation for these and other bridges across the CRD.

Spatial data were used to compile attribute data for each feature (e.g. parcel of land, length of road) that exists within the 2100 + 500-year storm surge scenario inundation line. For features that crossed over that inundation line only

the extent of the attribute (e.g. area, length) that exists inside the line was used. For example, if a parcel of land was 70% in the inundation line and 30% outside, only the 70% within the inundation line was included in the calculations.

2.6 Identification of Physical Shoreline Characteristics

The provincial BC Parks Shoreline Sensitivity to Sea Level Rise Model (BC Parks, undated) provides data on the physical shoreline type and sensitivity to SLR for all parts of the CRD coastline, as well as other parts of the province. This dataset was used to calculate two measures, both of which are reported in Appendix B:

- **Shoreline Type.** The model provides a determination of which category of foreshore type best applies to each segment of shoreline. The model uses a series of categories based on substrate, width and slope characteristics.
- **Sensitivity Rating.** The model provides an overall sensitivity to SLR rating for each segment of shoreline. This rating is based on separate sensitivity ratings derived for foreshore (based on substrate, width, slope, sediment mobility and exposure) and backshore (based on slope and coastal habitat type), with the most sensitive rating of the two being used for the overall sensitivity rating.

Appendix B provides a summary of the total length for each Shoreline Type and Sensitivity Rating category within the inundation line for the year 2100 + 500-year storm surge. The BC Parks Shoreline Sensitivity to Sea Level Rise Model report describes the relationship between shoreline type and sensitivity to SLR rating.

2.7 Valuation of Land and Improvements

The valuation of land and improvements[2] is based on BC Assessment data that represent an assessed market value for each property. BC Assessment's data were spatially linked to each parcel registered in the CRD's cadastral data layer. The market value assessment data were summed for land and for improvements present within the 2100 + 500-year storm surge inundation line for each SLR Focus Area. For parcels that crossed over that inundation line the valuation data were assigned proportionally to the area of land that is inside of the inundation line. As such, the analysis cannot account for the position of infrastructure (e.g. building footprints) within the parcel in relation to the inundation line[3]. Any area of the parcel within the inundation line that also extends beyond the shoreline to the ocean was also included in the valuation. This is particularly relevant for the Inner Harbour where there are a number of marine parcels, such as those that contain marine infrastructure.

Data analysis was conducted by AECOM using BC Assessment 2013 data and the method stated above. This analysis was then updated by CRD using BC Assessment 2014 data and refined cadastral data, and is reported in this report.

The total assessed market values are provided in Appendix B for each of the following categories of property:

- Residential
- Commercial
- Civic, Institutional And Recreational
- Transportation, Communication, And Utility
- Industrial
- Mining And Allied Industries
- Farm

[2] *Improvements are defined by BC Assessment as "any building, fixture, or other similar structure attached to land or another improvement".*

[3] *Spatial data on building footprints for the CRD region were reviewed and did not provide sufficient coverage across the region to allow for an analysis based on precise building location to be developed.*

- Forest & Allied Industry

The valuation data used for this task represent market values and should not be interpreted as the total financial cost or economic impact of SLR in these SLR Focus Areas. Actual property impact costs will be determined by:

- The level of adaptation that takes place prior to effects arising from SLR.
- The frequency and depth of inundation events that occur following SLR, and the impact that this has to property.

Within the scope of this project the BC Assessment data has been the sole data source for the aggregated data provided in Appendix B. For some publically owned properties that have not been subject to sale or have unique or restricted uses the extent to which BC Assessment valuation fully reflects market valuation would have to be reviewed and validated before using those valuation data for any further analysis.

The limitations of the BC Assessment data for estimating market value are:

- BC Assessment data for cadastral parcels registered on Indian Reserve land were not available for use in the valuation of land, and so the valuations provided in this report do not include the Indian Reserve land recorded in Appendix B. This is relevant to the valuation developed for the Port Renfrew and Island View SLR Focus Areas as these have relatively high areas of Indian Reserve land within the Focus Area. The valuation data for these two areas should be interpreted as low-end estimates that do not include the area of land in Indian Reserve (as stated in Appendix B) within the valuation.
- For the small number of other cadastral parcels that do not have an associated valuation in the BC Assessment database, a check was undertaken using 2013 BC Assessment data to determine if their absence from the analysis could significantly alter the total valuation estimates. The only other SLR Focus Area that includes a significant parcel without an associated valuation is in the Patricia Bay SLR Focus Area, where 23% of the assessed area did not have associated valuation data. For other SLR Focus Areas there were either no or minor (e.g. a few percentage points of total land area) levels of cadastral parcels without associated valuation data, or the cadastral parcels without valuation data would not significantly alter the valuation, because: they are undeveloped water lots that have been surveyed as cadastral parcels but do not have any identified development or economic use (present in the Jordan River and Highway 14 south of Shirley SLR Focus Areas), they are undeveloped water lots and relatively small parts of shoreline park (Gorge Esquimalt SLR Focus Area), or they are a single water lot (Central Ganges SLR Focus Area).

Within these limitations, the total valuation data presented in Appendix B should be interpreted as the total market value of property within areas that may be inundated in the 2100 + 500-year storm surge scenario. These valuation data are relevant as being *broadly indicative* of the values of land and improvements that may be at risk from effects from SLR. These are present day valuations and have not been discounted or in any other way altered to reflect that potential effects relate to a future time period. They do not include other costs associated with disaster recovery.

2.8 Valuation of Roads

This project developed and used replacement costs per unit length of road to calculate the total value of roads that are within the inundation line for the 2100 + 500-year storm surge scenario. These costs per unit length of road were applied to the total distances of road identified within the inundation line. The assumed replacement cost per unit length of road were estimated using AECOM in-house experience. Current unit costs for materials (asphalt course, crushed base course, sub grade/sub base) were used to develop estimates based on typical roadway design with shoulders of 1.5 m width, and lane width of 3.6 m, and road materials thicknesses as per Table 5. These stated road materials thicknesses are assumptions based on AECOM experience of roads in comparable conditions. In reality, roads will be built with thickness designed for site-specific conditions. The assumptions provide a reasonably indicative basis for deriving the cost estimates used to value road assets within the CRD.

The cost estimates are present day costs and have not been discounted or in any other way altered to reflect that potential effects relate to a future time period. They do not include other costs associated with disaster recovery.

Table 5 - Assumed Road Construction Material Thicknesses

Road Type	Arterial	Collector	Local
AC thickness	0.15 m	0.15 m	0.1 m
CBC thickness	0.3 m	0.2 m	0.2 m
SGSB thickness	0.5 m	0.4 m	0.3 m

(AC = asphalt course; CBC = crushed base course; SGSB – sub grade / sub base)

Construction costs also include estimates for keying in the road. Road appurtenances have been estimated and assumed to consist of ditches and central barriers for arterials, curbs for collectors, and curb and sidewalk for local roads. Detailed estimates of the different minor 2-lane road categories (restricted, strata, resource, recreation and service) was not possible within the scope of this work. They have been conservatively assumed to have the same cost as the 'local' 2-lane road category. The ferry 2-lane category has been assumed to be equal to an arterial lane.

The cost assumptions used for this project are applied to the category of road given in the attribute data provided in the CRD roads data layer (Table 6).

Table 6 - Cost assumptions used for different road types

Road type	Cost ($/m)	Road type	Cost ($/m)
Arterial minor and major		**Highway**	
Arterial Lane-2	$1,190	Highway	$1,850
Arterial Lane-3	$1,550	**Other 2 lane**	
Arterial Lane-4	$1,850	Restricted Lane 2	$770
Collector minor and major		Strata Lane 2	$770
Collector minor Lane-2	$870	Ferry Lane-2	$1,190
Collector minor Lane-3	$1,180	Resource Lane-2	$770
Collector minor Lane-4	$1,530	Recreation Lane-2	$770
Local		Service Lane 2	$770
Local Lane 1	$620		
Local Lane-2	$770		
Local Lane-3	$980		
Local Lane-4	$1,230		

2.9 Valuation of Key Public Assets

Valuation estimates were compiled for the key public assets that are present within the 2100 + 500-year storm surge scenario inundation line for the selected SLR Focus Areas. CRD and regional municipalities / electoral areas provided valuation data for a shortlist of publically-owned assets identified during the 'Identification of Key Assets' task (section 2.3). The valuation data were generally provided on a 'Cost of Reproduction New' or replacement cost basis, and so represent the full cost to reproduce the property in like kind and materials in accordance with current market prices. As with private property (see section 2.7) this valuation should not be interpreted as the total financial

cost or economic impact of SLR effects on these public assets. They do not include other costs associated with disaster recovery. Actual impact costs will be determined by:

- The level of adaptation that takes place prior to effects arising from SLR.
- The frequency and depth of inundation events that occur following SLR, and the impact that this has to property.
- Costs to acquire any new land for redevelopment of replacement assets and any extra costs incurred for developing in those new areas.

The valuation data for each of the public Key Assets presented in Appendix B should be interpreted as the total replacement cost of the public assets that exist within areas that may be inundated in the 2100 + 500-year storm surge scenario. These valuation data are relevant as being *broadly indicative* of the value of those selected public assets that may be at risk from SLR.

2.10 Service Disruption

The project included the development of three high-level case studies to characterize the potential service disruption and related economic effects that could arise from SLR. These case studies relate to each of the following three types of assets of importance to the CRD region:

- A transportation asset (case study of Highway 14, south of Shirley);
- A residential community (case study of Oak Bay / Windsor Park);
- A major business center (case study of Victoria's Inner Harbour).

These case studies were selected in consultation with CRD staff and were selected based on the anticipated inundation that would occur for the year 2100 + 500-year storm surge scenario.

The key economic costs of temporary service disruption caused by storm surge generated inundation are expected to include:

- Foregone revenues of businesses that cannot operate and related lost wages to employees;
- Extra costs incurred from both providing alternative service provision, where applicable, and repairing damaged service delivery infrastructure;
- Benefits lost to users from not being able to use the service and subsequent costs to users for utilizing alternative service options.

For each of the case studies, AECOM developed high-level estimates of the costs of these impact types to arrive at a total gross operational cost. Gross operational costs include all the above costs, with the exception of repairing damaged infrastructure.

The resulting estimates are meant to provide an order-of-magnitude understanding of potential impacts of disruption arising from SLR, *in present economic terms*. This analysis does not project changes in transportation mode shifts, business revenue, or population, which will ultimately determine future economic impacts. Instead, the case studies adopted a replicable methodology for assessing potential economic impacts according to existing economic conditions, using publically available data whenever possible. It is the intent of this analysis that each case study's methodology could be applied across the other Focus Areas or for other jurisdictions.

The "Total Economic Impact" of a case study is a gross measure of economic impact, which aggregates a series of metrics estimating externalities posed to different groups. The externalities considered in the following case studies are often interdependent and overlapping. For example, the business case study includes metrics of lost revenue, lost worker productivity, and lost sales tax revenue resulting from inundation impacting the Inner Harbour. Wage, output, and tax impacts are aggregated to determine the gross economic impact.

The service disruption valuation for all case studies is constrained by available model metrics. The selected metrics differ for each case study as they are designed to describe impacts to the specific asset types that are the focus for each case study. As a result, the service disruption valuation given each of the three case studies does not reflect the *total* service disruption effects for each Focus Area. For example, the transportation case study only includes relevant transportation metrics and so the valuation given for the Focus Area studied for that case study does not include other service disruption effects. For future work the metrics used across the three case studies could be applied together to each Focus Area in order to provide a more comprehensive valuation of total service disruption costs.

A detailed description of the methods used for these case studies is provided in Appendix C.

2.11 Summary of Source Data

For ease of reference, Table 7 lists the source data used for inundation mapping, identification of existing land use, and valuation of land and infrastructure. AECOM has not undertaken any validation of the accuracy of the data provided from these external data sets.

Table 7 - Summary of data sources used for project analysis

Land use / asset type	Data layer and attributes to report
Actual Land Use	• CRD data 'cdCadastre', attribute JUROL. • BC Assessment database – table 'tblValuation', column Actual_Use, linked by JUROL.
Zoning	• CRD data 'Municipal Zoning 2008', attribute ZoningCode • For Juan de Fuca: CRD data 'jfZoning', attribute Zoning Code.
First Nation Reserves	• CRD data 'adFirstNationReserves'
Physical Shoreline	• Provincial Shoreline Sensitivity Model layers 'StraitofGeorgia.kmz' and 'Juandefuca.kmz'.
Road	• CRD data 'trRoads', attributes: Road SubClass, Road Surface Type, Number of Lanes.
Rail	• CRD data 'trRail'.
Major Gas Pipeline	• Canvec data layer 'Pipeline' • Fortis BC gas distribution layer. This data layer shows the whole distribution system and was used to identify only the key parts of the system that could affect more regional supply.
Major Transmission Line	• Canvec data layer 'Transmission'
CRD stormwater and sanitary key assets – Discharge Points	• CRD's SanitaryStormwaterData.mdb, data layer ssDischargePoint.lyr
CRD stormwater and sanitary key assets – key structures	• CRD's SanitaryStormwaterData.mdb, data layer NetworkStructure.lyr
Key bridge assets	• Bridge elevation data for selected key bridges, provided by CRD. Data based on 2013 Lidar, NRC 2007 Lidar and Provincial TRIM.
Water Assets	• CRD's CRDWaterSupplyData.mdb, data layer s Network Structure.lyr, WaterStructure.lyr, ContainmentStructure.lyr.
Market value of land and improvements	• CRD data 'cdCadastre', attribute JUROL. BC Assessment database – table 'tblValuation', columns Land_1 to Land_10, Improvements_1 to Improvements_10. • BC Assessment database – table 'tblActualUse', columns Actual_Use and Type_Of.

3. Results

3.1 Sea Level Rise Focus Areas

A total of 24 SLR Focus Areas were defined (Table 8). These include at least one area for all regional municipalities and electoral areas apart from the City of Langford and the District of Highlands (Table 9). The location of these SLR Focus Areas is mapped in Figure 3.

Table 8 - List of SLR Focus Areas and their municipality or electoral area

#	Name	Municipality / Electoral Area
1	Port Renfrew	Juan de Fuca Electoral Area
2	Jordan River	Juan de Fuca Electoral Area
3	Highway 14 south of Shirley	Juan de Fuca Electoral Area
4	Milnes Landing	District of Sooke
5	Albert Head Lagoon	District of Metchosin
6	Esquimalt Lagoon	City of Colwood
7	Gorge – View Royal	Town of View Royal
8	Gorge – Saanich	District of Saanich
9	Gorge Industrial and Redevelopment Land	City of Victoria
10	Esquimalt DND Naval	Township of Esquimalt
11	Gorge - Esquimalt	Township of Esquimalt
12	Inner Harbour	City of Victoria
13	Ogden Point	City of Victoria
14	Dallas Road	City of Victoria
15	Oak Bay Windsor Park Area	District of Oak Bay
16	Cadboro Bay	District of Saanich
17	Island View Beach	District of Central Saanich
18	Patricia Bay	District of North Saanich
19	South Sidney	Town of Sidney
20	Tsehum Harbour – Sidney	Town of Sidney
21	Tsehum Harbour – North Saanich	District of North Saanich
22	Fulford Harbour	Salt Spring Island
23	Central Ganges	Salt Spring Island
24	Galliano – north of Sturdies Bay	Southern Gulf Islands

Table 9 - Count of SLR Focus Areas in each municipality and electoral area

Municipality or Electoral Area	Count	Municipality or Electoral Area	Count
City of Victoria	4	Town of View Royal	1
Juan de Fuca Electoral	3	District of Oak Bay	1
Salt Spring Island	2	District of Metchosin	1
Town of Sidney	2	City of Colwood	1
Township of Esquimalt	2	District of Central Saanich	1
District of North Saanich	2	Southern Gulf Islands	1
District of Saanich	2	City of Langford	0
District of Sooke	1	District of Highlands	0

3.2 Inundation Mapping

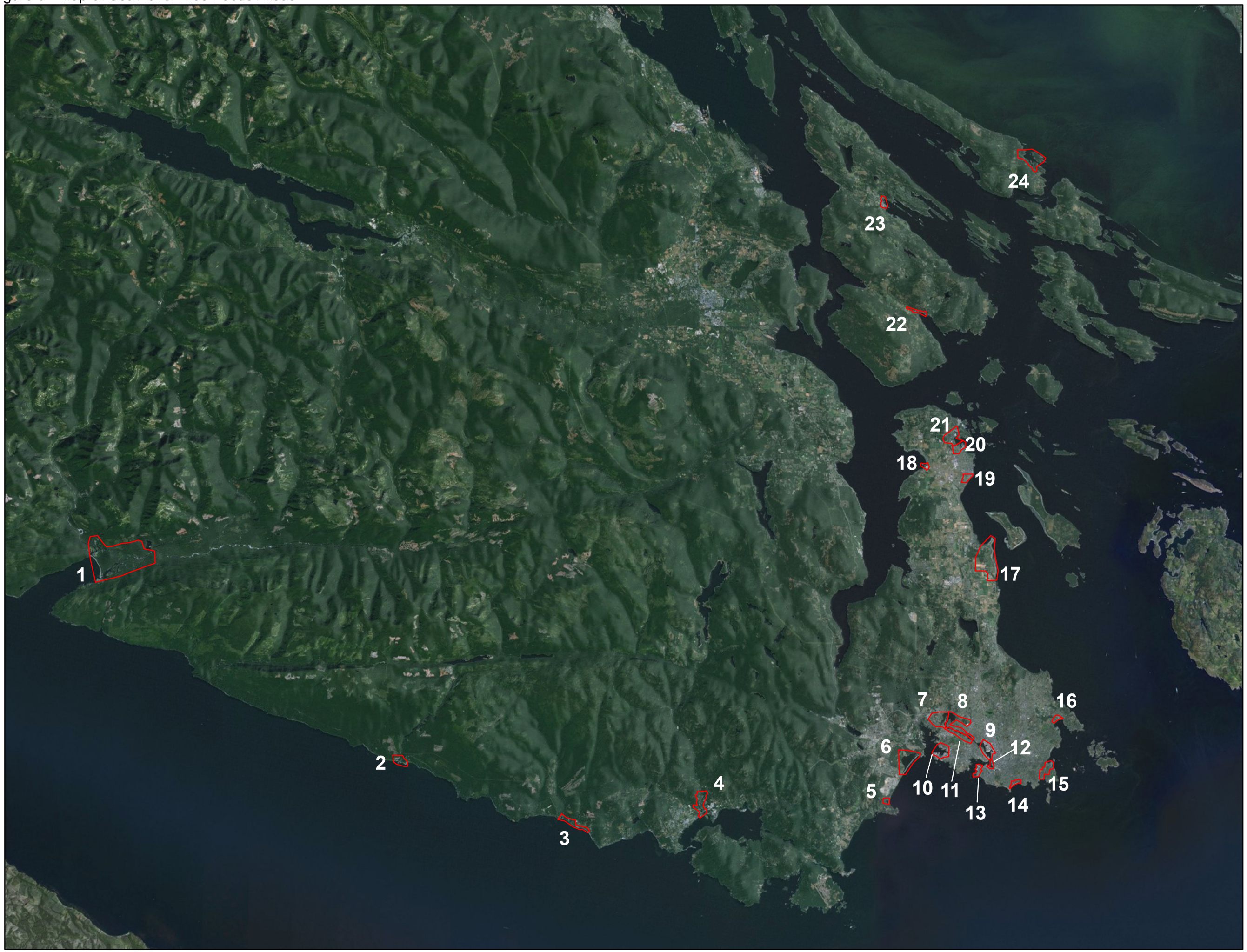
Example inundation maps for the Oak Bay Windsor Park Area are provided in Figure 4 with the full series of maps for all Focus Areas provided in Appendix A Map Book. Figure 4 is a series of maps for the different scenarios, presented in the following order:

- HHWLT + 0.5m SLR (year 2050 scenario)
- HHWLT + 0.5m SLR (year 2050 scenario) + 1.3m storm surge (500-year).
- HHWLT + 1m SLR (year 2100 scenario)
- HHWLT + 1m SLR (year 2100 scenario) + 1.3m storm surge (500-year).
- HHWLT + 2m SLR (year 2200 scenario)
- HHWLT + 2m SLR (year 2200 scenario) + 1.3m storm surge (500-year).

For the purposes of the land use and economic analysis (see sections 2.5 to 2.9) and calculation of inundation depths (see Table 10), the maps for the HHWLT + 1m SLR (year 2100 scenario) + 1.3m storm surge (500-year) scenario show a ‘Economic Impact Analysis Area’ polygon that gives the lateral definition of the SLR Focus Area, as described in Section 2.4. The polygon is generally drawn alongside or from roads and road junctions that are present close to but outside of the inundation line. Where this is not possible (e.g. lack of road infrastructure close to the inundation line) other land features have been used to provide the definition for this area.

Table 10 describes the inundation depths that would occur within the inundation line for the selected year 2100 + 500-year storm surge scenario.

Figure 3 - Map of Sea Level Rise Focus Areas



Capital Regional District
Inundation Mapping

Focus Areas

1 - Port Renfrew
2 - Jordan River
3 - Highway 14
4 - Milnes Landing
5 - Albert Head Lagoon
6 - Esquimalt Lagoon
7 - Gorge View-Royal
8 - Gorge View-Saanich
9 - Gorge View-Industrial Land
10 - Esquimalt DND
11 - Gorge View-Esquimalt
12 - Inner Harbour
13 - Ogden Point
14 - Dallas Road
15 - Oak Bay Windsor Park
16 - Cadboro Bay
17 - Island View Park
18 - Patricia Bay
19 - South Sidney
20 - Tsehum Harbour-Sidney
21 - Tsehum Harbour-North Saanich
22 - Fulford Harbour
23 - Central Ganges
24 - Galliano Island

N

0 2,700 5,400 10,800
Meters

CAPITAL REGIONAL DISTRICT

AECOM

Projection:
UTM Zone 10N, North American Datum 1983

Date: 5/5/2014

Figure 4 - Inundation maps for the Oak Bay Windsor Park Area SLR Focus Area

Provided as a separate document due to large file size.

Table 10 - Level of inundation for each SLR Focus Area (2100 + 500-year storm surge scenario)

			Area inundated by each depth interval (square km)								
Focus Area	Low-lying Disconnected Area (square km)	Total Area Inundated (square km)	0 - 50 cm	50 - 100 cm	100 -150 cm	150 - 200 cm	200 - 250 cm	250 - 300 cm	300 - 350 cm	350 - 400 cm	> 400 cm
Port Renfrew	0.01	7.78	1.06	0.41	1.91	0.65	2.67	0.19	0.47	0.05	0.37
Jordan River	0.00	0.37	0.08	0.12	0.05	0.03	0.02	0.02	0.02	0.03	0.00
Highway 14	0.00	0.53	0.03	0.05	0.08	0.03	0.02	0.02	0.02	0.00	0.00
Milnes Landing	0.01	0.49	0.05	0.06	0.06	0.06	0.10	0.09	0.07	0.00	0.00
Albert Head Lagoon	0.00	0.11	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Esquimalt Lagoon	0.00	0.33	0.03	0.05	0.09	0.05	0.04	0.03	0.04	0.00	0.00
Gorge View Royal	0.00	0.25	0.06	0.07	0.06	0.03	0.02	0.01	0.00	0.00	0.00
Gorge Saanich	0.00	0.23	0.05	0.05	0.05	0.03	0.03	0.02	0.00	0.00	0.00
Gorge Industrial Land	0.01	0.17	0.07	0.06	0.03	0.01	0.00	0.00	0.00	0.00	0.00
Esquimalt DND Naval	0.00	0.27	0.06	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.10
Gorge Esquimalt	0.00	0.10	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00
Inner Harbour	0.00	0.03	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Ogden Point	0.00	0.14	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dallas Road	0.00	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oak Bay Windsor Park	0.00	0.38	0.11	0.15	0.09	0.03	0.00	0.00	0.00	0.00	0.00
Cadboro Bay	0.00	0.17	0.02	0.02	0.02	0.03	0.06	0.00	0.00	0.02	0.00
Island View Park	0.00	1.46	0.03	0.03	0.07	0.18	0.23	0.56	0.30	0.06	0.00
Patricia Bay	0.00	0.17	0.04	0.02	0.00	0.00	0.00	0.00	0.01	0.10	0.00
South Sidney	0.00	0.21	0.05	0.08	0.06	0.02	0.00	0.00	0.00	0.00	0.00
Tsehum Harbour-Sydney	0.00	0.13	0.03	0.03	0.03	0.01	0.00	0.00	0.03	0.00	0.00
Tsehum Harbour-North Saanich	0.00	0.38	0.07	0.07	0.07	0.04	0.02	0.03	0.08	0.00	0.00
Fulford Harbour	0.00	0.09	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.02
Central Ganges	0.00	0.05	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galliano Island	0.00	0.15	0.02	0.03	0.02	0.02	0.03	0.04	0.00	0.00	0.00

3.3 Land Use, Roads and other Infrastructure

Appendix B provides the results of data analysis for actual land use, zoning, First Nation reserves, roads, transmission lines and pipelines for each SLR Focus Area. The only rail infrastructure identified was part of the E&N rail line in Focus Area number 9.

3.4 Shoreline Type and Sensitivity Rating

Appendix B provides the results of data analysis for Shoreline Type and Sensitivity Rating for each SLR Focus Area. The data show presence of a wide range of shoreline types and sensitivity ratings across the SLR Focus Areas, including different natural coastal classes as well as man-made classes. Sensitivity ratings to SLR are generally classed as Very High or High.

3.5 Identification and Valuation of Key Public Assets

The set of key public assets that were included for valuation as part of this project are listed in Table 11. This includes only those assets for which valuation data were available from CRD and municipalities and received within project reporting timescales. The basis for valuation is provided in the table and is typically replacement cost. This is one measure of asset value and does not indicate expected level of financial impact to the asset or any associated disaster recovery costs that could arise as a result of inundation. If these valuation data are used for planning purposes they should be verified and updated by CRD and / or municipalities and electoral area staff.

The key public assets that are included in this valuation and are present within the 2100 + 500-year storm surge inundation line are principally sewage and water pump stations, with a small number of buildings that provide other public services, including the City of Victoria public works yard and Ganges library. Appendix B provides a list of all key assets identified, including those for which valuation data were not available from CRD and municipalities. Within the scope of this project AECOM has not field-verified the asset data used for the study. Verification of asset locations should be completed prior to any site-specific planning or other work related to these locations.

Table 11 - List of key public assets that were included for valuation

Key public asset	SLR Focus Area #	Valuation	Basis for valuation
Port Renfrew Wastewater Treatment Plant plus 2 facilities marked as WTP disinfection facility for water	1	$654,400	Data provided for "Port Renfrew Sewage Treatment Plant". The data is for the "Cost of Reproduction New" value, as of November 2013's appraisal.
205 Portsmouth Drive Lift Station (Sewage)	6	$350,000	205 Portsmouth Drive lift station was installed in 2006 at an approximate cost of $350,000.
3301 Ocean Blvd Lift Station (Sewage)	6	$800,000	3301 Ocean Blvd lift station was installed in 2003 at an approximate cost of $800,000.
Esquimalt Lagoon Bridge	6	$2,500,000	Cost estimate of $2,500,000 to replace the entire bridge, developed in 2008.
Helmcken Park Pump Station (Sewage)	7	$275,900	2006 appraisal data.
Midwood Pump Station (Sewage)	7	$275,000	Up-to-date replacement cost estimate, but not based on formal appraisal.
Colquitz Pump Station (Sewage)	8	$265,600	Based on Cost of Reproduction New.
Dunkirk Lane Pump Station (Sewage)	8	$409,400	Based on Cost of Reproduction New.
Dysart Pump Station (Sewage)	8	$857,300	Based on Cost of Reproduction New.
Garbally Pump Station (Sewage)	9	$400,000	Installed in 1980, cost estimate of $400,000.
Harbour Pump Station (Sewage)	9	$420,000	Installed in 2007, cost estimate of $420,000.
Lower Public Works Yard	9	$4,887,000	Not all of this property would be inundated for this scenario. Replacement Land value for 417 Garbally, estimated in 2008. Buildings not included in valuation.
Craigflower Pump Station (Sewage)	11	$2,806,700	The data is for the "Cost of Reproduction New" value, as of November 2013's appraisal.
Memorial Pump Station (Sewage)	14	$300,000	Installed in 1974, cost estimate of $300,000.
Currie Lift Station Pump Station (Sewage)	15	$662,800	Not provided.
Penhryn Lift Station and Booster Pump Station (Sewage)	16	$3,206,900	Data provided for "Penrhyn Station". The data is for the "Cost of Reproduction New" value, as of November 2013's appraisal.
Gyro beach and park (valuation is for washrooms only)	16	$251,000	Based on Cost of Reproduction New.

Key public asset	SLR Focus Area #	Valuation	Basis for valuation
Island View Beach campground (valuation is for **toilet building and information kiosk** only)	17	$43,929	"Island View Beach – Toilet Building" valued at $27,033 and an "Island View Beach – Information Kiosk" valued at $16,896. Note: the available data could not be used to confirm if these specific facilities were in the part of the Island View beach that would be within the inundation line.
Sidney Pump Station (Sewage)	19	$3,952,800	The data is for the "Cost of Reproduction New" value, as of November 2013's appraisal.
Manson Road Pump Station (Sewage)	23	$154,400	The data is for the "Cost of Reproduction New" value, as of November 2013's appraisal.
Ganges Library	23	$6,200,000	Not provided. Part of this building may be outside of the inundation line.

3.6 Economic Valuation

Table 12 provides a summary of the total assessed value determined by BC Assessment for land and improvements that exist within the inundation line for the 2100 + 500-year storm surge scenario for each SLR Focus Area. Across the 24 SLR Focus Areas, residential property has the highest total assessed value, followed by commercial and then civic, institutional and recreational land uses. The SLR Focus Areas with the highest assessed values within this inundation line are:

- Oak Bay Windsor Park area, with $330million of assessed value, principally for residential property.
- Gorge Industrial and Redevelopment area, with $112million of assessed value, principally for the commercial and industrial categories.
- Esquimalt Naval, South Sidney and Tsehum North Saanich, each having total assessed values of close to $100million.

Table 12 - Summary of economic valuation (2014 BC Assessment data) for each SLR Focus Area ($Million)

SLR Focus Area Number and Name	Residential	Commercial	Civic, Institutional and Recreational	Transportation, Communication and Utility	Industrial	Farm	Mining and Allied Industry	Unclassified	Total
1. Port Renfrew	14.6	1.5	2.6	0.6	0.2	0.0	0.0	0.0	19.5
2. Jordan River	2.5	0.6	1.9	0.0	0.3	0.0	0.0	0.0	5.2
3. Hwy 14 Shirley	14.5	0.1	0.0	0.0	0.0	0.2	0.0	0.0	14.8
4. Milnes Landing	7.2	0.1	2.0	0.0	0.0	0.7	0.0	0.0	10.0
5. Albert Head	2.6	0.0	0.7	0.0	0.0	0.0	0.0	0.0	3.4
6. Esq Lagoon	13.5	2.8	9.1	0.0	0.0	0.0	0.0	0.0	25.4
7. Gorge View Royal	68.8	0.0	5.8	0.2	0.0	0.0	0.0	0.0	74.8
8. Gorge Saanich	31.9	2.1	12.2	0.0	0.0	0.0	0.0	0.0	46.2
9. Gorge Industrial	11.7	56.1	14.9	7.0	21.6	0.0	1.1	0.0	112.4
10. Esq DND Naval	0.0	0.0	45.8	13.2	35.1	0.0	0.0	4.5	98.5
11. Gorge Esquimalt	29.8	3.5	3.6	0.0	0.0	0.0	0.0	0.0	36.8
12. Inner Harbour[4]	16.0	20.5	1.9	23.2	0.0	0.0	0.0	0.0	61.6
13. Ogden Point	0.5	10.4	19.4	22.4	0.0	0.0	0.0	0.0	52.7
14. Dallas Rd	16.6	0.0	4.9	0.0	0.0	0.0	0.0	0.0	21.5
15. Oak Bay Windsor	299.2	19.3	10.6	1.0	0.0	0.0	0.0	0.0	330.1
16. Cadboro Bay	58.8	0.9	9.0	0.0	0.0	0.0	0.0	0.0	68.6
17. Island View Beach	9.4	1.9	17.9	0.0	0.0	0.3	0.0	0.0	29.5
18. Patricia Bay	0.0	0.0	5.4	0.4	0.0	0.0	0.0	0.0	5.8
19. South Sidney	68.9	2.5	14.1	8.2	0.0	0.0	0.0	0.0	93.6
20. Tsehum Sidney	52.0	19.1	5.1	0.0	0.6	0.0	0.0	0.0	76.8
21. Tsehum N Saanich	59.5	34.0	1.5	0.5	0.0	0.0	0.0	0.0	95.4
22. Fulford	1.5	2.8	0.1	1.5	0.4	0.1	0.0	0.0	6.4
23. Ganges	2.1	22.7	5.8	0.0	0.5	0.0	0.0	0.0	31.1
24. Galliano	7.9	0.0	0.0	0.1	0.1	0.0	0.0	0.0	8.1
Total	789.6	200.7	193.9	78.5	58.8	1.3	1.1	4.5	1328.3

Source: Data provided by CRD using 2014 BC Assessment data

Note: The Forestry and Allied Industry classification is not reported in this table as the total valuation for this classification was negligible. See Appendix B for data for this category.

[4] The Inner Harbour SLR Focus Area includes a number of high value parcels within the inundation line for this scenario. This includes water lots and a number of residential suite properties that exist as part of a parcel of land within the inundation line.

3.7 Service Disruption

3.7.1 Summary of Case Study Results

Table 13 summarizes the quantitative findings of the three case studies. For each case study, the Total Economic Impact ranges from $90,000 per day to more than $400,000 per day due to disruption from temporary inundation from storm surge events on transportation, residential community or business assets within one Focus Area. The figures can be extrapolated to give an indication of the economic impact of a permanent inundation scenario. The total daily economic impact is based on average year-round economic conditions. Considering that economic certain impacts, such as those related to tourism, will vary by season, AECOM also estimated daily impacts of service disruption during the winter months when service disruption is most likely to occur. As the table below illustrates, the daily impact of service disruption for the Victoria Inner Harbour drops by half when only winter tourism activity is considered.

A detailed explanation of the methodology used to arrive at total economic impacts can be found in Appendix C.

Table 13 - Summary of economic impacts for service disruption case studies

Case Study Type	Focus Area	Total Economic Impact per day of disruption (year-round average)	Total Daily Impact (winter months only) (1)	Focus Area Population (2)
Service Disruption Impacts on a Transportation Asset	Highway 14, south of Shirley	$92,015	$88,862	915 nearby residents
Service Disruption Impacts on a Residential Community	Oak Bay / Windsor Park	$9,979	NA	1,388 residents
Service Disruption Impacts on a Business District	Victoria Inner Harbour	$415,557	$214,322	161 workers (year-round) 125 workers (winter)

Note 1: Winter impacts were estimated only for indicators for which seasonal data was readily available. See Appendix for details on how daily impacts during the winter were calculated.

Note 2: The Focus Area population is the population of communities dependent on the transportation asset, the resident population of the residential community, and the estimated workforce of key business district employers. This population figure is meant to compare total impacts of each case study to Focus Area's size, in terms that are relevant to the type of service disruption. This does not imply that losses are only experienced by the population defined here. See Appendix C for sources of population data.

3.7.2 Transportation Disruption Case Study

3.7.2.1 Overview

The transportation disruption scenario assesses the economic impact of the temporary disruption of Highway 14, south of Shirley (Focus Area number 3). Figures for Focus Area 3 (see Appendix A Map Book) show the extent of inundation of Highway 14 for different scenarios. This case study assesses potential impacts for the scenario where storm surge events may temporarily disrupt Highway 14.

A storm surge event that inundates Highway 14 will disrupt the most direct route from Victoria to Port Renfrew (see Appendix A Map Book for relative position of these communities). Inundation of the route will result in fewer visits to the West Coast Trail and British Columbia's provincial parks, fewer riders on a popular private transportation service, longer in-bound and out-bound commute times for residents to the northwest of the Focus Area and higher costs for British Columbia's Emergency Services Unit to respond to emergencies.

3.7.2.2 Indicators and Data Metrics

Five indicators of economic impact are assessed for this case study:

- Commute costs
- Private transit costs
- Tourism costs
- Emergency services costs
- Fiscal costs

To quantify the economic impact of temporary service disruption along Highway 14, five corresponding metrics are used to determine the monetary value of the indicators. Metric calculations are intended to be replicable, meaning a similar process can be applied in determining the impacts of service disruptions to the same asset type in other areas. With this in mind, metrics rely on publically available data inputs whenever possible. These metrics, along with their data inputs, are summarized in the table below.

Table 14 – Transportation Disruption Cost Indicators

Indicator	Metric	Data Inputs
Commute Costs	Daily cost of lost time per worker	Number of vehicle trips per day
		Additional travel time required per trip from route impairment
		Average dollar value per hour of a commuter's time
Private Transit Costs	Daily cost of lost business revenue from service disruption	Average daily passengers
		Average revenue per passenger
Tourism Costs	Daily cost of lost tourism spending	Average daily visitors (provincial and national parks)
		Daily spending per visitor (provincial and national parks)
Emergency Services Costs	Daily cost of alternative emergency services	# of emergency response events per day
		Additional cost of air versus road response per event
Fiscal Costs	Daily cost of lost sales tax revenue	Output from "Tourist Costs" metric
		Provincial and general sales tax rates

3.7.2.3 Transportation Disruption Key Findings

Table 15 provides a summary of the daily economic impacts of transportation disruption caused by a storm surge that would inundate Highway 14. The final row, "Total Impacts", represents the sum of all five metrics that were used for this case study. Note that in some cases individual metrics are duplicative of others, meaning that the Total Impact reported here should be viewed as a gross, as opposed to a net measure of economic impact.[5] The rightmost column estimates the average daily impact during the winter only, when the West Coast Trail is not accessible.

In addition to total gross economic impacts, a per capita measure of economic impacts is displayed. For the transportation asset case study, the per capita economic impact is calculated by dividing total daily impacts by the estimated resident population of communities that would be most affected. For this case study these communities have been taken to be Shirley, Jordan River and Port Renfrew, which are close to or to the west of the point on the highway that would be inundated. While economic losses will be experienced by a wider population than these communities alone (including business owners and public agencies), the per capita figure places total impacts in the context of the Focus Area's size, and in terms that are relevant to the type of service disruption.

Table 15 - Transportation Disruption Total Impacts Summary

	Indicator	**Daily Impact (year round)**	**Daily Impact (winter scenario) (1)**
Transportation Disruption Impacts	Commute Costs	$52,776	$52,776
	Private transit costs	$950	$0
	Tourism Costs	$34,232	$32,325
	Emergency services cost	$298	$298
	Fiscal cost	$3,759	$3,463
	Total Impacts	**$92,015**	**$88,862**
	Population of Impacted Communities (Shirley, Jordan River, and Port Renfrew)	**915**	**915**
	Daily Impacts Per Capita	**$101**	**$97**

Note 1: Winter impacts exclude effects of West Coast Trail tourism and private transit to the West Coast trail, which is closed during the winter. Seasonal data was for provincial parks was not incorporated in the winter estimate due to data limitations.

[5] For example, private transit and tourism revenue are reported inclusive of sales tax. Fiscal impacts are also reported separately to reflect a distinct externality.

3.7.3 Community Disruption Case Study

3.7.3.1 Case Study Overview

The Community Disruption Case Study assesses the economic impacts of storm surge in the Oak Bay / Windsor Park Focus Area (see Figures for Focus Area 15 in Appendix A Map Book). A storm surge event that inundates the Oak Bay Focus Area has the potential to disrupt the life of local residents. Inundation of the neighborhood may result in disruption of utility service, longer commute times due to flooded roads, higher costs to deliver emergency services, the closure of recreation areas, and in the long run, lower property values and tax receipts because of flood risks. For some SLR and storm surge scenarios the inundation could occur in a way that makes the south-eastern portion of this area into a temporary "island". Without any management measures in place (e.g. to maintain a corridor of unflooded roads), this could prevent access to and from this part of the area, and this would drive some of the types of community disruption that are described below.

This case study assesses the potential economic impacts resulting from storm surge events that will cause temporary disruption of the delivery of public and utility services and the operation of recreational amenities in the Focus Area.

3.7.3.2 Indicators and Data Metrics

Five indicators of economic impacts are assessed in a quantitative manner for this case study:

- Emergency services costs
- Commute costs
- Residential utility disruption costs
- Fiscal risk

Three additional indicators (business disruption, recreation disruption, and transit disruption) are assessed in qualitative terms.

Replicable metrics are assigned to each indicator to determine the economic impact of service disruption in the Focus Area. Metrics rely primarily on publically available data inputs, with the intention of establishing a replicable process. These metrics, along with their data inputs, are summarized on the following page.

Table 16 - Overview of Community Impact Indicators and Metrics

	Indicator	Metric	Data Inputs
Service Disruption Impacts	Alternative Emergency Services Costs	Daily cost of alternative emergency services	# of emergency response events per day
			Additional cost of air versus road response per event
	Commute Costs	Daily cost of lost time per worker	Number of worker residents
			Additional travel time required per trip from route impairment
	Residential Utility Service Costs	Lost utility revenues per day	Average daily household utility spending
			Number of impacted households
Fiscal Risk	Fiscal Risk	Property tax revenues at risk of decline	Value of properties in focus area
			Local property tax rate
Qualitative impacts	Public Transit Impacts	Bus routes impacted by disruption	List of bus routes and general ridership data
	Recreation Costs	Closed recreation assets	Recreation assets in Focus Area
			Visitors / revenue if known
	Business Disruption	Number of local businesses	Business licenses
			Members of business improvement district

3.7.3.3 Community Disruption Key Findings

The following is a summary of the daily economic impacts of service disruption caused by a storm surge event in the Oak Bay / Windsor Park Focus Area. The final row, “Total Impacts”, represents the sum of four of the five

quantitative metrics; the Fiscal Risk metric is considered separately from the others because the metric expresses a cumulative risk, rather than an estimate of daily economic impacts. Winter impacts were not estimated for the Community Disruption Scenario, since indicator outcomes are not heavily dependent on tourism.

In addition to total gross daily economic impacts, a per capita measure of economic impacts is displayed. For the community disruption case study, the per capita economic impact is calculated by dividing total daily impacts by the estimated resident population. While economic losses will be experienced by a wider population than residents alone, the per capita figure places total impacts in the context of the Focus Area's size, in terms that are relevant to the type of service disruption.

Table 17 – Community Disruption: Quantitative Indicators Summary

Indicator	Daily Economic Impact
Commute Costs per day	$7,059
Emergency Services Cost per day	$441
Residential Utility Disruption Cost per day	$2,479
Total Daily Impacts	$9,979
Focus Area Population	1,388
Total Daily Impacts Per Capita	$7
Property Tax Revenues at Risk	$1,567,480

The Community Disruption Case study includes three qualitative assessments in addition to the quantitative metrics above; while these three additional economic impacts to the Focus Area cannot yet be quantified because of data limitations, the study recognizes their importance and thus includes them in the analysis. These three qualitative assessments cover impacts to public transit, recreation and local business.

Transit Impacts

The Focus Area is served by three bus routes: Route 2 – Oak Bay / Willows / Downtown (roughly 25,000 daily boardings along the entire route), Route 8 – Interurban / Oak Bay (roughly 20,000 daily boardings), and Route 1 – Downtown /Richardson (less than 20,000 passengers per day) (BC Transit 2011). At 11.4%, transit's share of passenger trips in the Oak Bay District, which encompasses the Focus Area, is higher than in any other area of the CRD outside of Victoria (Victoria Rapid Transit 2011).

Shifts in commute times for residents who live in the Focus Area are already quantified using the Commute Costs indicator listed in Table 17 above, although differences in impacts between transit riders and vehicle commuters are not considered. In addition to the impacts on workers who live in the Focus Area, it is likely, though not yet quantifiable, that a storm surge event in the Focus Area could impact the commute times of other transit users who rely on bus routes that pass through the Focus Area.

AECOM understands that transportation boarding data may be available at the Focus Area level. In future analyses, transit impacts could be developed as a quantitative indicator, measured either as lost revenue to the local transit agency, or the value of longer commute times for transit riders along the system.

Recreation Impacts

The Focus Area includes several recreation assets including the Monterey Elementary School fields and Windsor Park Field. Just outside the Focus Area is the private Victoria Golf Club, whose 1,200 members pay $37 million in membership fees, according to AECOM's estimate (Victoria News 2013 and AECOM analysis). It should be acknowledged that valuing recreation assets in terms of fees charged biases the analysis toward recreation assets located in high-income areas, as well as private recreation assets. In the future, the CRD may wish to explore more sophisticated valuation methods of recreation valuation (for example, valuing the intrinsic value of recreation assets, or quantifying the positive impacts of a park on public health).

Business Disruption

During storm events businesses may be forced to close down either because of flooding of a business establishment, or because of disruption in utility services that would impair safe business operations. In either case, these impacts would lead to a reduction in business revenue. The District of Oak Bay reports 600 active business licenses in the municipality, while the local business improvement district has 92 active members (Oak Bay 2014; Oak Bay BIA 2014). Public data were not available to determine the number of these businesses located in the Focus Area, or their aggregate revenues and number of employees. . It is AECOM's understanding that the CRD's employer database could provide local business data to support future analyses. The final case study of Business Disruption, below, presents a methodology for using primary research to determine the daily economic impacts of storm surge on local businesses in terms of wages and revenue, based on publically available employer data.

3.7.4 Business Disruption Case Study

3.7.4.1 Overview of Case Study

The Business Disruption Case Study assesses the economic impact of storm surge related flooding on major businesses located in Victoria's Inner Harbour (see Figures for Focus Area 12 in Appendix A Map Book). Disruption of harbour businesses will impact the revenue of firms, wages paid to workers (or worker productivity), as well as the behavior of tourists who rely on the Inner Harbour as an entry point to Victoria.

A storm surge event that inundates the Inner Harbour will impact the activities of businesses primarily in the transportation industry. These include the sea plane service company, Harbour Air, and the ferry companies Clipper Vacations and Blackball Ferry, which both operate international ferries between Victoria and Seattle and Port Angeles. The analysis only includes impacts on these businesses.

Smaller businesses in the area include restaurants, a gift shop, and licensed street vendors, many of which operate as tenants of properties owned by the Greater Victoria Harbour Authority. Impacts to these smaller businesses are not considered here due to data limitations.

3.7.4.2 Service Disruption Indicators and Data Metrics

Four indicators of economic impacts are assessed for this case study:

- Worker Productivity Costs
- Business Revenue Costs
- Tourism Costs
- Fiscal costs

Replicable metrics are used to determine the economic impact of business disruption for each of the above indicators. Whenever possible, metrics rely on publically available data to ensure the analysis can be replicated in other Focus Areas; however, in the case of business-level data, primary interviews were often necessary to supplement public information. Each indicator's metrics and data inputs are summarized in the table below.

Table 18 – Business Disruption Indicators and Metrics

	Indicator	Metric	Data Inputs
Business Disruption Impacts	Worker Productivity Cost	Daily cost of lost wages of disrupted business establishments (experienced either as lost income or reduced productivity)	Number of workers – large firms only (gathered from interviews / review of public documents)
			Average industry wage
	Business Revenue Cost	Daily cost of lost aggregate revenue of disrupted business establishments	Number of passengers – large firms (* will change by industry)
			Revenue per passenger
	Tourism Cost	Daily cost of lost ancillary tourist spending	Number of daily passengers
			Ancillary spending per passenger
	Fiscal Cost	Daily cost of lost sales tax revenue	Outputs from the Business Revenue and Tourism Cost Metrics above.
			General sales tax rate

3.7.4.3 Summary of Costs

The following is a summary of the daily economic impacts of service disruption caused by a storm surge event in the Inner Harbour Focus Area. The final row, "Total Impacts", represents the sum of all four metrics. Note that wage and revenue impacts are duplicative of one another, as wages are paid out of revenue. The Total Impacts row should therefore be viewed as a gross as opposed to a net economic impact. The rightmost column estimates the daily impact of service disruption during the winter months only, based on seasonal passenger data reported by Blackball Ferry only.

In addition to total gross economic impacts, a per capita measure of economic impacts is displayed. For the business disruption case study, the per capita economic impact is calculated by dividing total daily impacts by the estimated workforce population (including only those firms that publically report workforce data). While economic losses will be experienced by a wider population than workers alone, the per capita figure places total impacts in the context of the Focus Area's size, and in terms that are relevant to the type of service disruption.

Table 19 – Business Disruption Total Costs Summary

Indicator	Daily Impact (year-round)	Daily Impact (winter months) (1)
Wages / Productivity cost	$34,937	$27,023
Revenue cost	$160,373	$130,596
Tourism cost	$192,035	$45,598
Fiscal cost	$28,212	$11,105
Total Impacts	$415,557	$214,322
Worker Population of Focus Area (Blackball Ferry and Harbour Air)	161	125
Total Daily Impacts Per Capita (workforce)	$2,581	$1,714

Note 1: Winter impact uses winter ridership and winter tourist spending figures for Blackball Ferry. Winter employment for Blackball Ferry was also implied from these figures. For all other businesses, winter impacts were assumed to be constant (as seasonal data was not publically available).

4. Conclusions

The mapping and analysis developed as part of this project were used to draw the following conclusions:

a. As a result of varying topography there are different levels of inundation that may occur across the CRD coastline for the SLR and storm surge scenarios that were considered as part of this project. Many of the lower lying areas that may have higher levels of inundation coincide with developed and populated areas, leading to the potential for infrastructure damage, safety risk and service disruption.

b. The study of distinct coastal areas for SLR planning purposes requires that the provincial guidelines for floodplain mapping be applied along with a means for *laterally* defining these areas, i.e. applying the land-ward limit and a limit on the intersecting axis. By applying a set of principles for this lateral definition the project identified 24 SLR Focus Areas that have relatively high levels of expected future inundation and / or key community assets that are present in those areas. These are not the only areas of the CRD that may experience inundation for these scenarios, but were selected as key areas for which analysis could be conducted within the scope of this project, and which would help support CRD's longer term work in SLR risk management.

c. Almost all electoral areas and municipalities within the CRD have areas that contain at least one key community, transportation or business asset that would be inundated for the selected scenario of year 2100 + 500-year storm surge. These areas of inundation also include lands that are currently used for residential, commercial, civic / institutional and industrial purposes. The confirmed presence of these assets and land uses reinforces the need for CRD's work in identifying the potential risks that may arise from SLR and the appropriate management measures for the region.

d. The analysis provided in this report focuses on the assets that would be temporarily inundated under storm surge conditions for the selected scenario of SLR for year 2100 + 500-year storm surge. This does not imply long-term effect or destruction of this land or infrastructure. It does however identify the type and scale of assets that may be at risk from SLR. The key assets that would be at least partially inundated for this selected scenario are principally network structures for water and wastewater (pump stations, treatment plants), a library, a public works yard and some road bridges. There is the potential for some large businesses to be at least partially inundated for this scenario, with some of their operations (e.g. ferry, float plane) being regionally important for the tourism sector. There are also a large number of marine docks that are within the inundation line for this scenario, though it has not been assumed that infrastructure damage would necessarily occur to the dock structures themselves. Shoreline classification data show presence of a wide range of shoreline types and sensitivity ratings across the SLR Focus Areas, including different natural coastal classes as well as man-made classes. Sensitivity ratings to SLR are generally classed as Very High or High.

e. One of the main areas of Highway within the inundation line for the year 2100 + 500-year storm surge scenario is at Highway 14 between Sooke and Port Renfrew. This area was used as a case study for transportation service disruption. There are a small number of locations along this section that would be at least temporarily inundated during storm surge conditions for this scenario. As alternative routing in this area is limited, this inundation would disrupt movement of traffic between the Greater Victoria area and communities out to Port Renfrew, and could require re-routing via Lake Cowichan. As well as disruption to local residents this inundation could have effects for emergency response and for visitors accessing recreational sites and trails in this area.

f. Temporary inundation from storm surge also has the potential to disrupt other aspects of life for local residents. The case study of inundation in the Oak Bay / Windsor Park area shows extra costs incurred for emergency services, commuting, residential utility disruption, and recreation as well as fiscal risk from declining property tax.

g. For the 24 Focus Areas used for this project the total valuation of land and improvements within the year 2100 + 500-year storm surge inundation line ranges from $330 million (Oak Bay Windsor Park SLR Focus Area) to $3.4million (Albert Head SLR Focus Area). Across the 24 SLR Focus Areas, residential property has the highest total assessed value, followed by commercial and then civic, institutional and recreational land uses. The key public assets that were identified within the inundation lines and were subject to valuation in this project included pump stations (with varying valuations up to approximately $4million), and parts of the Lower Public Works yard and Ganges Library that may be subject to inundation and as a whole have multi-million dollar valuations.

h. This project has developed and applied a method for defining SLR Focus Areas, for characterising existing land uses, for identifying and valuing key public assets and for valuing land and infrastructure. While specific data sets may vary for other jurisdictions these methods will have relevance for assessing SLR risks for other areas.

5. Recommendations

The following recommendations are made:

a. That CRD use the analysis and mapping conducted for the 24 Focus Areas as an evidence base for the identification and appraisal of options for a future model bylaw that deals with SLR management for the CRD. In particular, the analysis provided in this project demonstrates the types of land use, key assets, services and indicative economic values that exist in areas at inundation risk and this evidence will help to develop the objectives for and assess the impacts of different management options.

b. That the digital files produced by this project for the entire CRD region are used for future work by the CRD and regional municipalities / electoral areas to assess areas not covered by the 24 Focus Areas. This application of data and the assessment methods applied by this project will be useful if a more localised and detailed review of SLR risks is undertaken by CRD or regional municipalities / electoral areas.

c. That CRD consider opportunities to communicate the approaches used in this project to other municipalities or Regional Districts that would benefit from identifying SLR risk in their coastal areas. The methods and data sets used for this project are not yet fully standardised or represented in guidelines and so this project may have value as a concept demonstrator for other local governments.

d. That CRD consider the value in assessing inundation risk that could occur from flooding of drainage and other water systems. This recommendation is based on feedback received by regional municipalities / electoral areas during the project that water could enter coastal outfalls and create a flow of water to low-lying inland areas that would not otherwise have direct connectivity to inundated areas. The assessment of such risks was not within the scope of this project and AECOM has not reviewed the potential for this to occur. Data generated from this project could be used to create maps to show where such non-connected low-lying areas are located.

Appendix A Map Book

Sea Level Rise Focus Area Map Book

Enclosed as six separate PDF documents

A separate map book is provided for each SLR scenario, with Focus Areas listed in the order as follows:

#	Name	Municipality / Electoral Area
1	Port Renfrew	Juan de Fuca Electoral Area
2	Jordan River	Juan de Fuca Electoral Area
3	Highway 14 south of Shirley	Juan de Fuca Electoral Area
4	Milnes Landing	District of Sooke
5	Albert Head Lagoon	District of Metchosin
6	Esquimalt Lagoon	City of Colwood
7	Gorge – View Royal	Town of View Royal
8	Gorge – Saanich	District of Saanich
9	Gorge Industrial and Redevelopment Land	City of Victoria
10	Esquimalt DND Naval	Township of Esquimalt
11	Gorge - Esquimalt	Township of Esquimalt
12	Inner Harbour	City of Victoria
13	Ogden Point	City of Victoria
14	Dallas Road	City of Victoria
15	Oak Bay Windsor Park Area	District of Oak Bay
16	Cadboro Bay	District of Saanich
17	Island View Beach	District of Central Saanich
18	Patricia Bay	District of North Saanich
19	South Sidney	Town of Sidney
20	Tsehum Harbour – Sidney	Town of Sidney
21	Tsehum Harbour – North Saanich	District of North Saanich
22	Fulford Harbour	Salt Spring Island
23	Central Ganges	Salt Spring Island
24	Galliano – north of Sturdies Bay	Southern Gulf Islands

Appendix B

Focus Area Land Use and Valuation Statistics

Key to table headings:

- Actual Land Use, Zoning, First Nation Reserves:
  - Area (sq-m) – total area of land registered for each category that is within the 2100 + 500 year storm surge scenario.
  - % of total – area of land registered for the given category within the 2100 + 500 year storm surge scenario as a percentage of total area of land (registered for all categories) that is within the 2100 + 500 year storm surge scenario.
- Physical Shoreline:
  - Length (m) – total length of shoreline that is within the 2100 + 500 year storm surge scenario, for each shoreline category.
  - % of total - length of shoreline that is within the 2100 + 500 year storm surge scenario, for each shoreline category, as a percentage of the total length of shoreline (registered for all shoreline categories) that is within the 2100 + 500 year storm surge scenario.
- Land Valuation
  - Total Land Value – total value of parcel (BC Assessment data) within the 2100 + 500 year storm surge scenario. Valuation data provided by CRD using 2014 BC Assessment data.
  - Total Improvements Value – total value of Improvements (BC Assessment data) within the 2100 + 500 year storm surge scenario. Valuation data provided by CRD using 2014 BC Assessment data.
  - Total Value – total value of land and improvements (BC Assessment data) within the 2100 + 500 year storm surge scenario. Valuation data provided by CRD using 2014 BC Assessment data.
- Roads
  - Length - total length of road that is within the 2100 + 500 year storm surge scenario, for each road category.

SLR Focus Area # 1 - Port Renfrew

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	2,454,956	36%
2 ACRES OR MORE - VACANT	1,425,511	21%
INDUSTRIAL - VACANT	1,107,333	16%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	1,002,412	15%
VACANT	342,835	5%
CAMPGROUND (COMMERCIAL)	233,835	3%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	106,680	2%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	59,658	1%
SINGLE FAMILY DWELLING	53,985	1%
2 ACRES OR MORE - OUTBUILDING	39,631	1%
2 ACRES OR MORE - SEASONAL DWELLING	39,194	1%
PARKS & PLAYING FIELDS	15,926	0.2%
VACANT RESIDENTIAL LESS THAN 2 ACRES	8,449	0.1%
RESIDENTIAL OUTBUILDING ONLY	5,924	0.1%
SEASONAL RESORT	3,377	0.0%
MANUFACTURED HOME - (NOT IN MANUFACTURED HOME PARK)	1,574	0.0%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	1,083	0.0%
WATER DISTRIBUTION SYSTEMS	850	0.0%
SEASONAL DWELLING	845	0.0%
CHURCHES & BIBLE SCHOOLS	743	0.0%
STORE(S) AND LIVING QUARTERS	698	0.0%
MARINE FACILITIES - MARINA	275	0.0%
RANGER STATION	205	0.0%

Zoning

Zoning Category	Area (sq-m)	% of total
Municipal Zoning		
MP	183,039	55%
ALR	73,697	22%
CR-1	53,817	16%
CU	19,445	6%
IND	2,836	1%
JF_Zoning		
AG	3,291,454	52%
P	2,005,302	31%
RL	503,532	8%
GR	235,705	4%
MP	183,038	3%
ALR	73,697	1%
CR-1	53,817	1%
CU	18,747	0.3%
CD-2A	7,166	0.1%
IND	2,836	0.0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
Gordon River First Nation Reserve No. 2	475,653
Pacheena First Nation Reserve No. 1	387,828

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Estuary (Organics/Fines)	21,361	59%
Sand and Gravel Beach, narrow < 30m	4,425	12%
Sand Beach, wide > 30m	4,104	11%
Sand Flat, wide > 30m	2,718	8%
Sand and Gravel Flat or Fan, wide > 30m	1,841	5%
Man made, permeable	1,331	4%
Rock Ramp, narrow < 30m	131	0%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	25	0%
Sensitivity Rating		
Very high sensitivity	32,587	91%
High sensitivity	3,257	9%
Low sensitivity	92	0%

Land Valuation

Category of Land	Total Land Value	Total Improv'ts Value	Total Value
Residential	$8,838,731	$5,717,155	$14,555,887
Civic, Institutional and Recreational	$2,543,496	$31,764	$2,575,259
Commercial	$856,842	$633,101	$1,489,943
Transportation, Communication and Utility	$143,799	$477,198	$620,997
Industrial	$220,880	$0	$220,880

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	7,832	770	$6,030,431
Subclass-resource Lane-2	2,014	770	$1,550,855
Subclass-collector minor Lane-2	1,375	870	$1,195,963
Subclass-recreation Lane-2	448	770	$344,796
Subclass-arterial minor Lane-2	62	1190	$73,847

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Port Renfrew Wastewater Treatment Plant and 2 facilities marked as WTP disinfection	$ 654,400
Community of Port Renfrew	
Port Renfrew Pump Station	
Deering Rd Bridge (North)	
Deering Rd Bridge (South)	
Island Rd Bridge	

SLR Focus Area # 2 - Jordan River

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
INDUSTRIAL - VACANT	109,296	28%
PARKS & PLAYING FIELDS	90,950	23%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	78,907	20%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	52,856	13%
LOGGING OPERATIONS	19,698	5%
IMPROVED	13,541	3%
MISCELLANEOUS (FOREST AND ALLIED INDUSTRY)	12,664	3%
SINGLE FAMILY DWELLING	7,370	2%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	4,932	1%
RESTAURANT ONLY	2,310	1%
VACANT RESIDENTIAL LESS THAN 2 ACRES	290	0%
2 ACRES OR MORE - VACANT	132	0%
OFFICE BUILDING (PRIMARY USE)	8	0%

Zoning

Zoning Category	Area (sq-m)	% of total
Municipal Zoning		
A	193,755	53%
B	169,857	47%
Juan de Fuca Zoning		
A	193,755	42%
No Zone	133,653	29%
RL	118,601	26%
JR-1	5,175	1%
CR-1A	4,932	1%
C-1B	4,794	1%
RR-2A	132	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)	% of total
None identified		

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline type		
Gravel Flat, wide > 30m	2,673	69%
Man made, permeable	555	14%
Gravel Beach, narrow < 30m	546	14%
Sand and Gravel Flat or Fan, wide > 30m	123	3%
Sensitivity Rating		
High sensitivity	3,351	86%
Moderate sensitivity	546	14%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$1,271,034	$1,217,198	$2,488,232
Civic, Institutional and Recreational	$1,795,918	$81,059	$1,876,977
Commercial	$146,900	$416,000	$562,900
Industrial	$38,885	$238,079	$276,964
Forest and Allied Industry	$2,000	$0	$2,000

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-highway_minor Lane-2	960	1850	$1,775,701
Subclass-recreation Lane-2	243	770	$187,347
Subclass-service Lane 2	315	770	$242,427

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Jordan River Bridge	-
Jordan River campground	-
Log sort business	-

SLR Focus Area # 3 - Highway 14 South of Shirley

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
NO JUROL IDENTIFIER; LAND USE UNKNOWN	100,656	38%
2 ACRES OR MORE - VACANT	49,838	19%
VACANT RESIDENTIAL LESS THAN 2 ACRES	31,489	12%
SINGLE FAMILY DWELLING	26,555	10%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	19,873	7%
OTHER	17,870	7%
MIXED	8,646	3%
2 ACRES OR MORE - SEASONAL DWELLING	7,928	3%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	3,721	1%
SAND & GRAVEL (VACANT AND IMPROVED)	191	0%
INDUSTRIAL - VACANT	134	0%

Zoning

Zoning Category	Area (sq-m)	% of total
Municipal Zoning		
A	107,624	38%
RR-A	63,343	23%
AF	45,359	16%
AG	44,336	16%
R-4	17,252	6%
B	1,980	1%
JF_Zoning		
RR-OB	64,230	33%
A	43,038	22%
AF	39,308	20%
AG	36,902	19%
R-4	8,696	5%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)	% of total
None identified		

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline type		
Sand and Gravel Flat or Fan, wide > 30m	4,242	64%
Gravel Flat, wide > 30m	1,847	28%
Sand and Gravel Beach, narrow < 30m	520	8%
Sensitivity Rating		
High sensitivity	6,089	92%
Moderate sensitivity	520	8%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$10,386,364	$4,135,640	$14,522,003
Farm	$9,730	$208,885	$218,615
Commercial	$29,752	$27,204	$56,956
Industrial	$9,695	$0	$9,695

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-highway_minor **Lane**-2	789	1850	$1,459,370

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Section of Highway 14	-
Muir Creek Bridge	-

SLR Focus Area # 4 -Milnes Landing

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	99,365	25%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	93,641	23%
2 ACRES OR MORE - VACANT	62,671	15%
PARKS & PLAYING FIELDS	34,664	9%
CAMPGROUNDS (INCLUDES GOVERNMENT CAMPGROUNDS, YMCA & CHURCH, ETC). (EXCLUDES COMMERCIAL CAMPGROUND).	25,593	6%
GRAIN & FORAGE	20,062	5%
SINGLE FAMILY DWELLING	17,340	4%
MIXED	14,912	4%
MIXED - VACANT	11,433	3%
2 ACRES OR MORE - OUTBUILDING	6,532	2%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	6,007	1%
VACANT RESIDENTIAL LESS THAN 2 ACRES	5,624	1%
OTHER - VACANT	4,143	1%
OTHER	2,019	0%
RESIDENTIAL OUTBUILDING ONLY	594	0%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	181	0%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	102	0%
GOLF COURSES (INCLUDES PUBLIC & PRIVATE)	86	0%
MANUFACTURED HOME - (NOT IN MANUFACTURED HOME PARK)	25	0%
NEIGHBOURHOOD PUB	18	0%
DUPLEX - SINGLE UNIT OWNERSHIP	0	0%

Zoning

Zoning Category	Area (sq-m)	% of total
RU3	162,490	42%
P1	116,269	30%
RU2	90,326	23%
CD2-C	7,363	2%
R1	3,983	1%
W7	3,939	1%
RR1A	2,260	1%
M4	2,019	1%
CD2-E	224	0%
CD2-B	113	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
T'Sou-ke First Nation Reserve No. 1	2,655

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand and Gravel Beach, narrow < 30m	942	93%
Sand and Gravel Flat or Fan, wide > 30m	67	7%
Sensitivity Rating		
High sensitivity	1,008	100%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$5,179,015	$2,040,529	$7,219,544
Civic, Institutional and Recreational	$1,910,915	$79,323	$1,990,238
Farm	$309,428	$373,922	$683,349
Commercial	$79,977	$53,720	$133,697

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	298	770	$229,230
Subclass-arterial major Lane-2	112	1190	$133,726

Major Transmission and Pipelines

Part of the Fortis gas distribution line passes through this focus area. This is the only line shown to serve Sooke and so is classed as an important part of this system

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Sooke Flats Campground	-
Sun River Nature Trail	-

SLR Focus Area # 5 - Albert Head Lagoon

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	70,889	77%
SINGLE FAMILY DWELLING	11,057	12%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	4,549	5%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	2,472	3%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	2,318	3%
VACANT RESIDENTIAL LESS THAN 2 ACRES	1,137	1%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	96	0%

Zoning

Zoning Category	Area (sq-m)	% of total
P3	75,444	79%
RR1	20,630	21%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Estuary (Organics/Fines)	854	58%
Sand and Gravel Beach, narrow < 30m	474	32%
Sand and Gravel Flat or Fan, wide > 30m	141	10%
Sensitivity Rating		
Very high sensitivity	854	58%
Moderate sensitivity	460	31%
High sensitivity	154	10%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$1,663,244	$972,633	$2,635,877
Civic, Institutional and Recreational	$663,830	$42,865	$706,695
Commercial	$15,289	$17,285	$32,574

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	154	770	$118,681

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Regional Park	-

SLR Focus Area # 6 - Esquimalt Lagoon

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	110,682	35%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	62,562	20%
SCHOOLS & UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS (INCLUDES PRIVATE KINDERGARTENS).	42,177	13%
2 ACRES OR MORE - VACANT	41,485	13%
STORE(S) AND SERVICE - COMMERCIAL	14,689	5%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	8,293	3%
VACANT RESIDENTIAL LESS THAN 2 ACRES	7,876	3%
SINGLE FAMILY DWELLING	6,366	2%
RECREATIONAL & CULTURAL BUILDINGS (INCLUDES CURLING RINK ARENA, SWIMMING POOLS, MUSEUMS, HISTORICAL BUILDINGS, ART GALLERY, LIBRARIES) (EXCLUDE PARKS, GOLF COURSES & GOVERNMENT CAMPGROUNDS).	5,934	2%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	4,134	1%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	3,244	1%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	2,822	1%
GOVERNMENT RESERVES (INCLUDES GREENBELTS (NOT IN FARM USE), BIRD SANCTUARIES, ECOLOGY RESERVES, ETC).	1,793	1%
DUPLEX - SINGLE UNIT OWNERSHIP	1,448	0%

Zoning

Zoning Category	Area (sq-m)	% of total
P4	1,417,542	86%
R1	132,040	8%
AG1	75,988	5%
CD6	15,764	1%
AG2	3,103	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand Flat, wide > 30m	8,255	54%
Estuary (Organics/Fines)	6,756	44%
Sand and Gravel Beach, narrow < 30m	330	2%
Sensitivity rating		
Very high sensitivity	15,011	98%
Moderate sensitivity	330	2%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$10,139,377	$3,402,061	$13,541,438
Civic, Institutional and Recreational	$3,096,454	$5,969,448	$9,065,902
Commercial	$1,776,735	$975,014	$2,751,749

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	2,364	770	$1,820,374
Subclass-local Lane 1	501	620	$310,517
Subclass-collector minor Lane-2	102	870	$88,313

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Royal Roads University grounds	-
Ocean Blvd (road)	-
3301 Ocean Blvd Lift Station (Sewage)	$ 800,000
205 Portsmouth Drive Lift Station (Sewage)	$ 350,000
Bldg 32 Pump Station (Sewage)	-
Esquimalt Lagoon Bridge	$ 2,500,000

SLR Focus Area # 7 - Gorge View Royal

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
SINGLE FAMILY DWELLING	73,518	34%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	32,100	15%
MULTI-FAMILY - GARDEN APARTMENT & ROW HOUSING	26,106	12%
PARKS & PLAYING FIELDS	25,752	12%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	23,501	11%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	21,317	10%
SCHOOLS & UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS (INCLUDES PRIVATE KINDERGARTENS).	4,131	2%
GARBAGE DUMPS, SANITARY FILLS, SEWER LAGOONS, ETC.	4,003	2%
RAILWAY	1,846	1%
WATER DISTRIBUTION SYSTEMS	955	0%
VACANT RESIDENTIAL LESS THAN 2 ACRES	755	0%
PROPERTY SUBJECT TO SEC 19(8)	729	0%
RESIDENTIAL OUTBUILDING ONLY	274	0%

Zoning

Zoning Category	Area (sq-m)	% of total
VIEW ROYAL Residential 3	171,137	72%
VIEW ROYAL Residential 6	34,629	15%
P-1	25,386	11%
VIEW ROYAL Institutional Use 3	4,132	2%
VIEW ROYAL Institutional Use 1	1,898	1%
A-1	586	0%
VIEW ROYAL Residential 4	55	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Estuary (Organics/Fines)	2,093	37%
Man made, permeable	1,575	28%
Rock Ramp, narrow < 30m	1,391	25%
Rock Cliff, narrow < 30m	300	5%
Sand Beach, narrow < 30m	280	5%
Sensitivity Rating		
Very high sensitivity	5,611	100%
High sensitivity	27	0%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$44,429,035	$24,323,435	$68,752,470
Civic, Institutional and Recreational	$4,361,202	$1,435,784	$5,796,986
Transportation, Communication and Utility	$179,073	$41,154	$220,226

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	1,252	770	$964,201
Subclass-arterial minor Lane-2	259	1190	$307,668
Subclass-recreation Lane-2	78	770	$59,908
Subclass-restricted Lane 2	64	770	$49,292
Subclass-arterial_minor Lane 1	51	1530	$77,982

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Midwood Pump Station (Sewage)	$ 275,000
Helmcken Park Pump Station (Sewage)	$ 275,900

SLR Focus Area # 8 - Gorge Saanich

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	119,505	57%
SINGLE FAMILY DWELLING	41,916	20%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	13,807	7%
RECREATIONAL & CULTURAL BUILDINGS (INCLUDES CURLING RINK ARENA, SWIMMING POOLS, MUSEUMS, HISTORICAL BUILDINGS, ART GALLERY, LIBRARIES) (EXCLUDE PARKS, GOLF COURSES & GOVERNMENT CAMPGROUNDS).	9,628	5%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	8,486	4%
VACANT RESIDENTIAL LESS THAN 2 ACRES	4,936	2%
DUPLEX	2,415	1%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	2,006	1%
SHOPPING CENTRE - REGIONAL	1,410	1%
PARKS & PLAYING FIELDS	1,081	1%
MOTEL & AUTO COURT	857	0%
TRIPLEX	829	0%
RECREATIONAL CLUBS, SKI HILLS	660	0%
MULTI-FAMILY - APARTMENT BLOCK	303	0%
STORES AND/OR OFFICES WITH APARTMENTS	269	0%
SCHOOLS & UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS (INCLUDES PRIVATE KINDERGARTENS).	188	0%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	138	0%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	133	0%
MULTI-FAMILY - GARDEN APARTMENT & ROW HOUSING	98	0%

Zoning

Zoning Category	Area (sq-m)	% of total
P-1	598,581	72%
P-4N	111,615	13%
P-4	46,303	6%
RS-6	36,062	4%
RS-12	23,220	3%
A-1	11,105	1%
RS-13	4,673	1%
C-3	1,935	0%
RD-1	1,265	0%
C-10	1,003	0%
RA-1	852	0%
RA-3	345	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	3,221	46%
Rock Ramp, narrow < 30m	2,260	32%
Estuary (Organics/Fines)	1,126	16%
Sand and Gravel Beach, narrow < 30m	271	4%
Sand Beach, narrow < 30m	197	3%
Sensitivity Rating		
Very high sensitivity	6,514	92%
High sensitivity	560	8%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$24,239,226	$7,624,736	$31,863,962
Civic, Institutional and Recreational	$10,957,980	$1,228,534	$12,186,515
Commercial	$1,090,338	$1,054,790	$2,145,128
Transportation, Communication and Utility	$2,000	$0	$2,000

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-arterial major Lane-2	918	1190	$1,092,577
Subclass-Local Lane-2	341	770	$262,224
Subclass-arterial minor Lane-2	105	1190	$124,971
Subclass-collector minor Lane-4	20	1530	$29,923

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Colquitz Pump Station (Sewage)	$ 265,600
Dunkirk Lane Pump Station (Sewage)	$ 409,400
Dysart Pump Station (Sewage)	$ 857,300

SLR Focus Area # 9 - Gorge Industrial and Redevelopment Land

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
ELECTRICAL POWER SYSTEMS (INCLUDING NON-UTILITY COMPANIES)	24,374	12%
STORAGE & WAREHOUSING - CLOSED	21,235	10%
SHIPYARDS	20,456	10%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	19,387	9%
METAL FABRICATING INDUSTRIES	15,455	7%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	15,325	7%
INDUSTRIAL - VACANT	12,348	6%
CONCRETE MIXING PLANTS	12,314	6%
MISCELLANEOUS (TRANSPORTATION & COMMUNICATION)	9,026	4%
MARINE FACILITIES - MARINA	8,189	4%
STORE(S) AND OFFICES	7,904	4%
VACANT	5,485	3%
WORKS YARDS	5,037	2%
MISCELLANEOUS (MINING AND ALLIED INDUSTRIES)	4,775	2%
STORAGE & WAREHOUSING - OPEN	4,383	2%
AUTOMOBILE PAINT SHOP, GARAGES, ETC.	4,279	2%
MULTI-FAMILY - VACANT	4,243	2%
ASPHALT PLANTS	2,928	1%
OFFICE BUILDING (PRIMARY USE)	2,821	1%
PARKING - LOT ONLY, PAVED OR GRAVEL	2,220	1%
DOCKS & WHARVES	1,624	1%
COMMERCIAL STRATA-LOT	1,325	1%
STORE(S) AND SERVICE - COMMERCIAL	1,108	1%
MISCELLANEOUS & (INDUSTRIAL OTHER)	1,092	1%
AUTOMOBILE SALES (LOT)	951	0%
RECREATIONAL & CULTURAL BUILDINGS (INCLUDES CURLING RINK ARENA, SWIMMING POOLS, MUSEUMS, HISTORICAL BUILDINGS, ART GALLERY, LIBRARIES) (EXCLUDE PARKS, GOLF COURSES & GOVERNMENT CAMPGROUNDS).	808	0%
SAND & GRAVEL (VACANT AND IMPROVED)	796	0%
PARKS & PLAYING FIELDS	555	0%
RAILWAY	258	0%
NEIGHBOURHOOD PUB	243	0%
STRATA-LOT RESIDENCE (CONDOMINIUM)	121	0%
MULTI-FAMILY - APARTMENT BLOCK	41	0%
CEMENT PLANTS	12	0%
TRANSPORTATION EQUIPMENT INDUSTRY (INCLUDING AIRCRAFT, MOTOR VEHICLE, TRUCK BODY, RAILROAD, SHIPBUILDING, BOATBUILDING, AND REPAIR OF SAME).	0	0%

Zoning

Zoning Category	Area (sq-m)	% of total
M-3	132,412	49%
CD-9	21,018	8%
S-PH	17,758	7%
SD-1	17,594	6%
VHP	16,182	6%
CD-1	13,099	5%
M-2	12,139	4%
M-3S	8,931	3%
CA-W	6,281	2%
MS-4	4,676	2%
CA-19	4,257	2%
M2-G	3,909	1%
SD-2	3,832	1%
CD-5	3,827	1%
M-G	1,850	1%
CA-3C	1,326	0%
M2-I	1,265	0%
CA-34	633	0%
M3-C	289	0%
R-2	209	0%
S-3	191	0%
M-4	91	0%
T-1	48	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
New Songhees First Nation Reserve No. 1A	453

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	5,091	89%
Sand and Gravel Beach, narrow < 30m	348	6%
Rock Ramp, narrow < 30m	262	5%
Sensitivity Rating		
High sensitivity	3,783	66%
Very high sensitivity	1,919	34%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Commercial	$26,640,747	$29,473,019	$56,113,766
Industrial	$17,486,908	$4,137,422	$21,624,332
Civic, Institutional and Recreational	$12,916,527	$1,934,424	$14,850,951
Residential	$9,318,163	$2,396,053	$11,714,216
Transportation, Communication and Utility	$6,224,427	$797,847	$7,022,273
Mining and Allied Industry	$1,081,636	$4,829	$1,086,465

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	1,108	770	$853,345
Subclass-arterial major Lane-2	176	1190	$209,496
Subclass-collector major Lane-3	139	1180	$163,820
Subclass-collector major Lane-4	25	1530	$37,575

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Point Hope dockyard	
Dockland Green private power facility	
Point Ellice Bay St road bridge (note: elevation above water level for this scenario)	
Concrete plant	
Steel facility	
Lower Public Works Yard	$ 4,887,000
Jutland Business District	
Harbour Pump Station (Sewage)	$ 420,000
Garbally Pump Station (Sewage)	$ 400,000

Johnson St Bridge (road bridge, 133m of E&N rail though this was not identified as operational, Galloping Goose regional trail) (note: elevation of bridge above water level for this scenario)

Selkirk Trestle: Galloping Goose regional trail (note: bridge elevation above water level for this scenario)

SLR Focus Area # 10 - Esquimalt DND Naval

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
DOCKS & WHARVES	129,192	56%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	84,173	36%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	11,359	5%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	6,949	3%

Zoning

Zoning Category	Area (sq-m)	% of total
ESQUIMALT Institutional Use 2	102,542	58%
ESQUIMALT Commercial 4	74,624	42%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	4,757	91%
Sand and Gravel Beach, narrow < 30m	196	4%
Rock Ramp with Gravel Beach, narrow < 30m	175	3%
Rock Ramp, narrow < 30m	113	2%
Sensitivity Rating		
High sensitivity	5,042	96%
Very high sensitivity	122	2%
Moderate sensitivity	78	1%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Civic, Institutional and Recreational	$19,297,826	$26,470,416	$45,768,242
Industrial	$22,043,840	$13,053,082	$35,096,922
Transportation, Communication and Utility	$13,186,000	$0	$13,186,000
Unclassified	$1,372,417	$3,098,353	$4,470,770

Roads

Road Category	Length (m)	Valuation
No registered roads in this Focus Area	-	-

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
DND Naval Base	
Federal land leased to Seaspan (shipyard)	
Pump Station No 2 (Sewage)	
Rainbow Pump Station (Sewage)	
Signal Hill Pump Station No 2 (Sewage)	
Lift Station from Bldg 126 Pump Station No 2 (Sewage)	
Pump Station No 11 (Sewage)	
Graving Dock Lift Station No 14 (Sewage)	
North Wharf Lift Station No 15 (Sewage)	

SLR Focus Area # 11 - Gorge Esquimalt

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
NO JUROL IDENTIFIER; LAND USE UNKNOWN	101,830	68%
SINGLE FAMILY DWELLING	23,412	16%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	7,687	5%
HOTEL	7,203	5%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	2,136	1%
Code 300 (not defined by BC Assessment)	1,942	1%
VACANT RESIDENTIAL LESS THAN 2 ACRES	1,569	1%
STRATA-LOT RESIDENCE (CONDOMINIUM)	1,094	1%
MULTI-FAMILY - APARTMENT BLOCK	1,059	1%
DUPLEX - UP & DOWN	996	1%
BED & BREAKFAST OPERATION 4 OR MORE UNITS	706	0%
NURSING HOME	329	0%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	98	0%
TRIPLEX	62	0%
DUPLEX	59	0%
ROW HOUSING - SINGLE UNIT OWNERSHIP	56	0%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	16	0%
DUPLEX - SINGLE UNIT OWNERSHIP	3	0%

Zoning

Zoning Category	Area (sq-m)	% of total
ESQUIMALT Recreation 1	48,562	33%
Data layer gives no attribute data; unknown zoning	42,347	28%
ESQUIMALT Residential 3	30,575	21%
P-1	12,326	8%
ESQUIMALT Mixed Use 4	7,160	5%
ESQUIMALT Residential 4	5,336	4%
ESQUIMALT Residential 6	2,487	2%
VIEW ROYAL Recreation 2	71	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	1,456	49%
Estuary (Organics/Fines)	870	29%
Rock Ramp, narrow < 30m	479	16%
Sand Beach, narrow < 30m	192	6%
Sensitivity Rating		
Very high sensitivity	2,265	76%
High sensitivity	732	24%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$20,196,783	$9,566,472	$29,763,254
Civic, Institutional and Recreational	$3,551,542	$26,897	$3,578,439
Commercial	$2,947,500	$511,227	$3,458,727
Transportation, Communication and Utility	$2,000	$0	$2,000
Unclassified	$1	$0	$1

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	179	770	$137,900
Subclass-collector minor Lane-4	21	1530	$32,175
Subclass-recreation Lane-2	36	770	$27,352
Subclass-arterial major Lane-2	102	1190	$121,155

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Forshaw Pump Station (Sewage)	-
Craigflower Pump Station (Sewage)	$ 2,806,700
Sewage Storage Chamber (Sewage)	-

SLR Focus Area # 12 - Inner Harbour

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
MARINE FACILITIES - MARINA	54,168	45%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	26,772	22%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	18,500	15%
PARKING - LOT ONLY, PAVED OR GRAVEL	16,634	14%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	2,337	2%
PARKS & PLAYING FIELDS	701	1%
VACANT	490	0%
STORE(S) AND OFFICES	339	0%
STORE(S) AND SERVICE - COMMERCIAL	309	0%
STRATA-LOT RESIDENCE (CONDOMINIUM)	261	0%
OFFICE BUILDING (PRIMARY USE)	113	0%
COMMERCIAL STRATA-LOT	8	0%

Zoning

Zoning Category	Area (sq-m)	% of total
IH-PARK	22,813	19%
IHT2	22,711	19%
IHBA	21,002	18%
IHSN	18,084	15%
IHT3	14,432	12%
IHSS	7,174	6%
IHR	6,050	5%
IHM	5,947	5%
IHF	398	0%
IHH	307	0%
CA-W	18	0%
IHB	2	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	1,806	100%
Sensitivity rating		
High sensitivity	1,806	100%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Transportation, Communication and Utility	$14,856,683	$8,389,913	$23,246,596
Commercial	$16,688,285	$3,795,523	$20,483,807
Residential	$10,581,483	$5,412,753	$15,994,236
Civic, Institutional and Recreational	$1,904,378	$7,290	$1,911,668

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-ferry Lane-2	229	1190	$272,460
Subclass-Local Lane-2	17	770	$13,157

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Coho ferry terminal	
Clipper terminal	
Customs facilities	
Marina and floating docks	
Harbour Air terminal	

SLR Focus Area # 13 - Ogden Point

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
MARINE FACILITIES - MARINA	191,238	75%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	57,668	23%
OFFICE BUILDING (PRIMARY USE)	5,375	2%
VACANT	905	0%
TRIPLEX	297	0%
SINGLE FAMILY DWELLING	267	0%
HOTEL	51	0%
STRATA LOT - PARKING RESIDENTIAL	32	0%
COMMERCIAL STRATA-LOT	3	0%

Zoning

Zoning Category	Area (sq-m)	% of total
M-2	109,123	61%
M-S-1	64,602	36%
VHP	3,909	2%
MS-3	73	0%
R3-L	41	0%
MS-2	32	0%
R2-36	30	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	3,327	97%
Rock Cliff, narrow < 30m	86	3%
Sensitivity Rating		
High sensitivity	2,754	81%
Very high sensitivity	659	19%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Transportation, Communication and Utility	$12,880,410	$9,565,011	$22,445,420
Civic, Institutional and Recreational	$16,557,211	$2,844,532	$19,401,739
Commercial	$6,291,010	$4,067,099	$10,358,108
Residential	$327,988	$206,572	$534,560

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-collector major Lane-2	29	870	$24,976
Subclass-Local Lane-2	11	770	$8,455

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Fishermens Wharf (tourism attraction and houseboats)	-
Greater Victoria Harbour Authority, Helijet and Coastguard facilities	-
Cruise ship terminal	-

SLR Focus Area # 14 - Dallas Road

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	70,478	83%
CEMETARIES (INCLUDES PUBLIC OR PRIVATE).	6,502	8%
SINGLE FAMILY DWELLING	2,653	3%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	2,499	3%
TRIPLEX	922	1%
DUPLEX	778	1%
DUPLEX - UP & DOWN	532	1%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	272	0%
MULTI-FAMILY - APARTMENT BLOCK	188	0%
STRATA-LOT RESIDENCE (CONDOMINIUM)	88	0%
STRATA LOT - PARKING RESIDENTIAL	88	0%
DUPLEX - SINGLE UNIT OWNERSHIP	7	0%

Zoning

Zoning Category	Area (sq-m)	% of total
R1-B	23,525	68%
R3-2	1,717	5%
R-J	8,936	26%
R1-G	408	1%
R1-18	84	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand and Gravel Beach, narrow < 30m	1,503	73%
Gravel Beach, narrow < 30m	431	21%
Rock Ramp, narrow < 30m	69	3%
Rock Platform with Sand and Gravel Beach, wide > 3	62	3%
Sensitvity Rating		
High sensitivity	1,634	79%
Very high sensitivity	431	21%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$12,127,760	$4,513,012	$16,640,773
Civic, Institutional and Recreational	$4,861,478	$274	$4,861,752

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-arterial minor Lane-2	596	1190	$709,310
Subclass-local Lane 1	191	620	$118,521
Subclass-Local Lane-2	161	770	$124,084

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Dallas Road (key road route) and seawall	-
Ross Bay cemetery	-
Memorial Pump Station (Sewage)	$ 300,000

SLR Focus Area # 15 - Oak Bay Windsor Park Area

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
SINGLE FAMILY DWELLING	160,287	51%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	35,581	11%
MARINE FACILITIES - MARINA	30,824	10%
No JUROL identified; land use is unknown	17,143	5%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	16,825	5%
PARKS & PLAYING FIELDS	14,990	5%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	10,338	3%
MULTI-FAMILY - APARTMENT BLOCK	6,296	2%
DUPLEX	5,748	2%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	4,675	1%
STORE(S) AND LIVING QUARTERS	3,931	1%
MULTI-FAMILY - HIGH-RISE	2,666	1%
DUPLEX - UP & DOWN	1,589	1%
BED & BREAKFAST OPERATION 4 OR MORE UNITS	1,351	0%
SCHOOLS & UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS (INCLUDES PRIVATE KINDERGARTENS).	1,336	0%
MULTI-FAMILY - MINIMAL COMMERCIAL	1,177	0%
MULTI-FAMILY - CONVERSION	754	0%
TRIPLEX	580	0%
STORE(S) AND SERVICE - COMMERCIAL	515	0%

Zoning

Zoning Category	Area (sq-m)	% of total
RS5	240,501	42%
P4	146,432	26%
P1	82,026	14%
CS2	34,765	6%
RS4	15,795	3%
RM3	14,762	3%
RM4	13,423	2%
C2	12,300	2%
RM8	4,877	1%
P2	2,074	0%
C1	1,731	0%
RM2	904	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	557	26%
Sand and Gravel Flat or Fan, wide > 30m	511	24%
Sand and Gravel Beach, narrow < 30m	347	16%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	331	15%
Rock Ramp with Gravel Beach, narrow < 30m	219	10%
Rock Ramp, narrow < 30m	98	5%
Man made impermeable	92	4%
Sensitivity Rating		
High sensitivity	1,424	66%
Very high sensitivity	639	30%
Moderate sensitivity	92	4%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$217,274,200	$81,915,177	$299,189,377
Commercial	$13,216,215	$6,059,947	$19,276,162
Civic, Institutional and Recreational	$9,504,596	$1,079,701	$10,584,297
Transportation, Communication and Utility	$277,521	$747,488	$1,025,009

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	3,434	770	$2,644,059
Subclass-Collector Minor Lane-2	1,452	870	$1,263,269
Subclass-arterial minor Lane-2	659	1190	$783,868

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
East-west road routes that connect to residential areas and golf course	
Windsor Park	
St Christopher's school	
Currie Lift Station Pump Station (Sewage)	$ 662,800

SLR Focus Area # 16 - Cadboro Bay

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
SINGLE FAMILY DWELLING	60,671	46%
PARKS & PLAYING FIELDS	24,457	19%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	16,352	12%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	11,509	9%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	7,392	6%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	4,822	4%
VACANT RESIDENTIAL LESS THAN 2 ACRES	4,390	3%
DUPLEX	1,276	1%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	248	0%
STRATA-LOT RESIDENCE (CONDOMINIUM)	13	0%
VACANT	8	0%
MULTI-FAMILY - CONVERSION	7	0%
ROW HOUSING - SINGLE UNIT OWNERSHIP	6	0%

Zoning

Zoning Category	Area (sq-m)	% of total
RS-10	62,379	36%
P-4	58,519	34%
P-1	27,323	16%
RS-12A	18,592	11%
RD-1	1,892	1%
P-2	1,442	1%
C-2	650	0%
RS-8	456	0%
RS-16	159	0%
RS-6	85	0%
RT-3	0	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand Flat, wide > 30m	1,402	90%
Rock Ramp with Sand Beach, wide > 30m	159	10%
Sensitivity Rating		
Very high sensitivity	1,402	90%
High sensitivity	159	10%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$44,884,263	$13,876,980	$58,761,243
Civic, Institutional and Recreational	$6,050,999	$2,942,000	$8,992,999
Commercial	$756,625	$130,653	$887,278

Roads

Road Category	Total Length	Unit cost	Valuation
Subclass-Local Lane-2	655	770	$504,104
Subclass-Collector Major Lane-2	93	870	$80,987

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Gyro beach and park (valuation for washrooms only)	$ 251,000
Penhryn Lift Station and Booster Pump Station (Sewage)	$ 3,206,900

SLR Focus Area # 17 - Island View Park

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	514,491	40%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	465,656	36%
VACANT	79,773	6%
OTHER	58,518	4%
VEGETABLE & TRUCK	48,684	4%
VEGETABLE & TRUCK - VACANT	46,934	4%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	22,494	2%
SINGLE FAMILY DWELLING	17,438	1%
INDUSTRIAL - VACANT	14,523	1%
MISCELLANEOUS (FOREST AND ALLIED INDUSTRY)	14,523	1%
PARKS & PLAYING FIELDS	12,876	1%
TELEPHONE	3,096	0%
VACANT RESIDENTIAL LESS THAN 2 ACRES	1,666	0%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	1,114	0%

Zoning

Zoning Category	Area (sq-m)	% of total
W1	689,175	45%
P2	552,620	36%
A1	259,108	17%
RE2	18,284	1%
RE5	16,763	1%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
East Saanich First Nation Reserve No. 2	458,553

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand and Gravel Flat or Fan, wide > 30m	2,960	33%
Estuary (Organics/Fines)	2,753	31%
Sand Flat, wide > 30m	2,177	24%
Sand and Gravel Beach, narrow < 30m	961	11%
Rock Platform with Sand and Gravel Beach, wide > 3	102	1%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	58	1%
Sensitivity Rating		
Very high sensitivity	8,459	94%
High sensitivity	553	6%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Civic, Institutional and Recreational	$17,847,127	$37,500	$17,884,627
Residential	$6,160,559	$3,284,218	$9,444,777
Commercial	$1,899,960	$0	$1,899,960
Farm	$24,780	$246,525	$271,305
Industrial	$4,757	$0	$4,757
Transportation, Communication and Utility	$1,253	$0	$1,253
Forest and Allied Industry	$386	$0	$386

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	1,798	770	$1,384,647

Major Transmission and Pipelines

Major electric transmission line of 371m length

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Regional park	
Island view campground (value for toilet and kiosk only)	$ 43,929
Tsawout Pollution Control Centre (Sewage)	

SLR Focus Area # 18 - Patricia Bay

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
AIRPORTS, HELIPORTS, ETC.	137,289	63%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	49,617	23%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	20,221	9%
GOVERNMENT RESEARCH CENTRES (INCLUDES NURSERIES & FISH HATCHERIES).	11,899	5%

Zoning

Zoning Category	Area (sq-m)	% of total
P-3	135,510	61%
AP-1	49,858	23%
M-6	25,061	11%
P-1	8,806	4%
P-4	1,622	1%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	674	58%
Sand Flat, wide > 30m	445	39%
Rock Platform with Sand and Gravel Beach, wide > 3	34	3%
Sensitivity Rating		
Very high sensitivity	904	78%
High sensitivity	249	22%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Civic, Institutional and Recreational	$1,285,301	$4,159,603	$5,444,904
Transportation, Communication and Utility	$359,741	$38,108	$397,850

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	144	770	$110,562

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Float plane terminal	
Institute of Ocean Sciences Pump Station (Sewage)	

SLR Focus Area # 19 - South Sidney

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
SINGLE FAMILY DWELLING	46,723	29%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	37,566	23%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	26,965	17%
STORE(S) AND OFFICES	18,961	12%
GARBAGE DUMPS, SANITARY FILLS, SEWER LAGOONS, ETC.	7,804	5%
DUPLEX - SINGLE UNIT OWNERSHIP	5,223	3%
STRATA-LOT RESIDENCE (CONDOMINIUM)	5,125	3%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	3,351	2%
MOTEL & AUTO COURT	2,861	2%
ROW HOUSING - SINGLE UNIT OWNERSHIP	2,163	1%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	1,233	1%
DUPLEX	1,100	1%
BED & BREAKFAST OPERATION LESS THAN 4 UNITS	962	1%
MULTI-FAMILY - CONVERSION	384	0%
VACANT RESIDENTIAL LESS THAN 2 ACRES	338	0%
VACANT	258	0%
CHURCHES & BIBLE SCHOOLS	191	0%
PARKS & PLAYING FIELDS	37	0%

Zoning

Zoning Category	Area (sq-m)	% of total
R1.2	71,874	30%
P1	60,455	25%
U2	32,068	13%
W3	15,509	6%
R1.1	14,693	6%
R2	8,670	4%
RM5.2	8,254	3%
C5.2	5,994	2%
U1	5,821	2%
U3	5,077	2%
RM4	4,590	2%
CD	3,642	2%
RM1.2	3,338	1%
I2	425	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made, permeable	1,058	61%
Man made impermeable	460	26%
Sand and Gravel Flat or Fan, wide > 30m	220	13%
Sensitivity Rating		
High sensitivity	1,518	87%
Very high sensitivity	220	13%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$48,498,382	$20,406,380	$68,904,762
Civic, Institutional and Recreational	$9,747,230	$4,306,116	$14,053,346
Transportation, Communication and Utility	$7,147,251	$1,064,971	$8,212,222
Commercial	$1,981,057	$494,665	$2,475,722

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	2,739	770	$2,108,806
Subclass-recreation Lane-2	75	770	$57,632
Subclass-collector major Lane-2	665	870	$578,893
Subclass-strata Lane 2	88	770	$67,378

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Sidney to Anacortes Ferry Terminal	
Sidney Pump Station (Sewage)	$3,952,800

SLR Focus Area # 20 - Tsehum Harbour Sidney

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	21,248	23%
MARINE FACILITIES - MARINA	19,701	21%
ROW HOUSING - SINGLE UNIT OWNERSHIP	17,140	18%
STRATA-LOT RESIDENCE (CONDOMINIUM)	10,344	11%
SINGLE FAMILY DWELLING	7,689	8%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	6,102	6%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	5,419	6%
DUPLEX - SINGLE UNIT OWNERSHIP	2,176	2%
PARKS & PLAYING FIELDS	1,676	2%
STORE(S) AND LIVING QUARTERS	1,526	2%
SHIPYARDS	599	1%
OFFICE BUILDING (PRIMARY USE)	442	0%

Zoning

Zoning Category	Area (sq-m)	% of total
W3	193,907	42%
W1	168,691	37%
P1	23,588	5%
R2	18,710	4%
RM3	17,116	4%
RM5.2	16,278	4%
W2	12,767	3%
M-6	4,127	1%
R1.1	1,157	0%
C5	389	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand Flat, wide > 30m	795	27%
Man made impermeable	633	21%
Man made, permeable	536	18%
Rock Ramp, narrow < 30m	241	8%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	217	7%
Sand and Gravel Beach, narrow < 30m	155	5%
Rock Ramp with Sand and Gravel Beach, wide > 30m	146	5%
Rock Cliff with Sand and Gravel Beach, narrow < 30	126	4%
Rock Platform with Sand and Gravel Beach, wide > 3	98	3%
Sensitivity Rating		
High sensitivity	1,707	58%
Very high sensitivity	1,240	42%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$34,262,731	$17,781,588	$52,044,319
Commercial	$13,793,916	$5,331,022	$19,124,937
Civic, Institutional and Recreational	$5,040,067	$10,315	$5,050,382
Industrial	$389,903	$220,342	$610,245
Unclassified	$1	$0	$1

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-strata Lane 2	574	770	$442,360
Subclass-Local Lane-2	533	770	$410,754
Subclass-collector minor Lane-2	355	870	$308,719

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Large marina facilities	
Harbour Pump Station (Sewage)	

SLR Focus Area # 21 - Tsehum Harbour N Saanich

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
SINGLE FAMILY DWELLING	99,006	40%
MARINE FACILITIES - MARINA	85,160	34%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	21,439	9%
MULTI-FAMILY - GARDEN APARTMENT & ROW HOUSING	14,128	6%
VACANT RESIDENTIAL LESS THAN 2 ACRES	8,283	3%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	5,259	2%
RESIDENTIAL OUTBUILDING ONLY	4,697	2%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	4,145	2%
No JUROL identified; land use is unknown	2,675	1%
ROW HOUSING - SINGLE UNIT OWNERSHIP	2,482	1%
STRATA-LOT RESIDENCE (CONDOMINIUM)	1,213	0%
SCHOOLS & UNIVERSITIES, COLLEGE OR TECHNICAL SCHOOLS (INCLUDES PRIVATE KINDERGARTENS).	337	0%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	125	0%

Zoning

Zoning Category	Area (sq-m)	% of total
M-6	545,843	60%
M-3	119,128	13%
R-2	117,559	13%
M-4	50,275	6%
M-2	40,143	4%
P-4	16,726	2%
RM-2	14,128	2%
P-1	1,274	0%
M-5	688	0%

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Mud Flat, wide > 30m	3,211	40%
Sand Flat, wide > 30m	1,652	20%
Man made impermeable	893	11%
Man made, permeable	601	7%
Rock Ramp, narrow < 30m	463	6%
Rock Platform with Sand Beach, wide > 30m	433	5%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	405	5%
Rock Ramp with Sand and Gravel Beach, wide > 30m	233	3%
Rock Platform with Sand and Gravel Beach, wide > 3	80	1%
Rock Cliff, narrow < 30m	80	1%
Sand Beach, narrow < 30m	77	1%
Sensitivity Rating		
Very high sensitivity	5,768	71%
High sensitivity	2,361	29%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$36,386,822	$23,118,092	$59,504,913
Commercial	$24,805,685	$9,161,787	$33,967,472
Civic, Institutional and Recreational	$1,284,227	$167,459	$1,451,686
Transportation, Communication and Utility	$504,000	$0	$504,000

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	1,153	770	$888,023
Subclass-collector minor Lane-2	264	870	$229,925
Subclass-strata Lane 2	140	770	$107,571

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Large marina facilities	

SLR Focus Area # 22 Fulford Harbour

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	19,769	23%
DOCKS & WHARVES	15,566	18%
MARINE & NAVIGATIONAL FACILITIES (INCLUDES FERRY LANDINGS, BREAKWATERS, BOAT RAMPS, LIGHTHOUSES, FORESHORE FACILITIES, ETC).	13,224	16%
MIXED	9,684	11%
2 ACRES OR MORE - SEASONAL DWELLING	8,048	9%
MOTEL & AUTO COURT	7,162	8%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	2,819	3%
SINGLE FAMILY DWELLING	2,147	3%
MARINE FACILITIES - MARINA	1,637	2%
MIXED - VACANT	1,379	2%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	1,072	1%
RESTAURANT ONLY	590	1%
CHURCHES & BIBLE SCHOOLS	467	1%
INDUSTRIAL - VACANT	452	1%
SEASONAL DWELLING	316	0%
VACANT RESIDENTIAL LESS THAN 2 ACRES	291	0%
STORE(S) AND LIVING QUARTERS	287	0%
RESIDENTIAL OUTBUILDING ONLY	184	0%
TELEPHONE	126	0%
STORE(S) AND SERVICE - COMMERCIAL	27	0%

Zoning

Zoning Category	Area (sq-m)	% of total
No Municipal Zoning data for this Focus Area		

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Sand and Gravel Flat or Fan, wide > 30m	825	46%
Rock Cliff with Sand and Gravel Beach, narrow < 30	523	29%
Man made, permeable	270	15%
Rock Ramp with Sand and Gravel Beach, wide > 30m	58	3%
Rock Cliff, narrow < 30m	47	3%
Rock Platform with Sand and Gravel Beach, wide > 3	36	2%
Sand and Gravel Beach, narrow < 30m	24	1%
Sensitivity Rating		
High sensitivity	1,136	64%
Low sensitivity	565	32%
Moderate sensitivity	82	5%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Commercial	$1,483,232	$1,296,204	$2,779,436
Residential	$1,146,810	$372,054	$1,518,864
Transportation, Communication and Utility	$1,101,048	$410,198	$1,511,246
Industrial	$308,338	$57,692	$366,029
Farm	$12,693	$99,520	$112,213
Civic, Institutional and Recreational	$67,307	$700	$68,007

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	127	770	$97,882
Subclass-collector minor Lane-2	310	870	$269,844
Subclass-ferry Lane-2	225	1190	$268,097

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
Main road to / from Fulford Harbour	
Fulford marina and ferry terminal	
Fulford-Ganges Rd Bridge	

SLR Focus Area # 23 - Central Ganges

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
NO JUROL IDENTIFIER; LAND USE UNKNOWN	69,957	41%
DOCKS & WHARVES	42,761	25%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	19,066	11%
STORE(S) AND SERVICE - COMMERCIAL	14,400	8%
STORE(S) AND OFFICES	6,347	4%
MARINE FACILITIES - MARINA	4,095	2%
VACANT RESIDENTIAL LESS THAN 2 ACRES	3,205	2%
Code 300 (not defined by BC Assessment)	1,985	1%
RESIDENTIAL OUTBUILDING ONLY	1,823	1%
VACANT	1,573	1%
BED & BREAKFAST OPERATION 4 OR MORE UNITS	1,439	1%
GOVERNMENT BUILDINGS (INCLUDES COURTHOUSE, POST OFFICE, MUNICIPAL HALL, FIRE HALL, POLICE STATIONS, ETC). (EXCLUDES TYPICAL OFFICE BUILDINGS; REFER TO COMMERCIAL SECTIONS).	1,287	1%
SINGLE FAMILY DWELLING	1,167	1%
STORE(S) AND LIVING QUARTERS	804	0%
BANK	792	0%
SEASONAL DWELLING	620	0%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	283	0%
SERVICE STATION	265	0%
ROW HOUSING - SINGLE UNIT OWNERSHIP	108	0%
SINGLE FAMILY DWELLING WITH BASEMENT SUITE	96	0%
STORAGE & WAREHOUSING - CLOSED	8	0%

Zoning

Zoning Category	Area (sq-m)	% of total
No Municipal Zoning data for this Focus Area		

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Man made impermeable	892	33%
Man made, permeable	543	20%
Rock Ramp, narrow < 30m	392	14%
Rock Ramp with Sand and Gravel Beach, narrow < 30m	278	10%
Rock Platform with Sand and Gravel Beach, wide > 3	222	8%
Sand and Gravel Beach, narrow < 30m	201	7%
Sand and Gravel Flat or Fan, wide > 30m	105	4%
Sand Flat, wide > 30m	85	3%
Sensitivity Rating		
Very high sensitivity	1,333	49%
High sensitivity	927	34%
Moderate sensitivity	457	17%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Commercial	$9,619,565	$13,110,649	$22,730,214
Civic, Institutional and Recreational	$2,294,376	$3,476,728	$5,771,105
Residential	$1,688,764	$443,717	$2,132,481
Industrial	$302,016	$148,845	$450,861
Unclassified	$2	$0	$2

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	257	770	$97,882
Subclass-collector minor Lane-2	121	870	$269,844
Subclass-strata Lane 2	51	1	$225

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets; see main report for basis for valuation]

Asset Name	Valuation where available
Fire hall	
Library	$6,200,000
Main road to / from Ganges	
Manson Road Pump Station (Sewage)	$154,400

SLR Focus Area # 24 - Galliano Island

Actual Land Use

Actual Land Use Category	Area (sq-m)	% of total
ELECTRICAL POWER SYSTEMS (INCLUDING NON-UTILITY COMPANIES)	41,836	27%
SEASONAL DWELLING	25,311	17%
TELEPHONE	18,374	12%
2 ACRES OR MORE - SINGLE FAMILY DWELLING, DUPLEX	17,143	11%
VACANT RESIDENTIAL LESS THAN 2 ACRES	14,340	9%
RESIDENTIAL OUTBUILDING ONLY	9,507	6%
SINGLE FAMILY DWELLING	7,278	5%
2 ACRES OR MORE - VACANT	6,182	4%
DOCKS & WHARVES	5,216	3%
CIVIC, INSTITUTIONAL & RECREATIONAL - VACANT	3,911	3%
NO JUROL IDENTIFIER; LAND USE UNKNOWN	1,675	1%
LOGGING OPERATIONS	1,256	1%
2 ACRES OR MORE - SEASONAL DWELLING	354	0%
2 ACRES OR MORE - MANUFACTURED HOME	53	0%

Zoning

Zoning Category	Area (sq-m)	% of total
No Municipal Zoning data for this Focus Area		

First Nation Reserves

Reserve name (First Nation)	Area (sq-m)
None identified	

Physical Shoreline

Physical Shoreline Category	Length (m)	% of total
Shoreline Type		
Rock Ramp, wide > 30m	1,167	19%
Rock Platform, wide > 30m	1,164	19%
Rock Ramp with Sand Beach, narrow < 30m	886	15%
Rock Cliff, narrow < 30m	752	12%
Sand Flat, wide > 30m	511	8%
Gravel Beach, narrow < 30m	383	6%
Sand and Gravel Beach, narrow < 30m	309	5%
Rock Ramp, narrow < 30m	302	5%
Sand and Gravel Flat or Fan, wide > 30m	298	5%
Rock Ramp with Sand Beach, wide > 30m	187	3%
Man made, permeable	136	2%
Sensitivity Rating		
High sensitivity	3,593	59%
Moderate sensitivity	1,410	23%
Low sensitivity	579	10%
Very high sensitivity	511	8%

Land Valuation

Category of Land	Total Land Value	Total Improve'ts Value	Total
Residential	$5,784,325	$2,112,262	$7,896,587
Industrial	$59,955	$40,693	$100,648
Transportation, Communication and Utility	$56,788	$0	$56,788
Civic, Institutional and Recreational	$22,088	$0	$22,088

Roads

Road Category	Length (m)	Unit cost	Valuation
Subclass-Local Lane-2	184	770	$97,882

Major Transmission and Pipelines

No major assets identified

Key Assets

[valuation given for selected public assets]

Asset Name	Valuation where available
No Key Assets identified. This area was included as a Focus Area as representative of shoreline residential for Southern Gulf Islands Electoral Area	

Appendix C
Methods for service disruption case studies

1. Transportation Disruption Case Study - Method

1.1 Commute Costs

The Commute Costs metric is defined as the daily cost of lost time per worker resulting from longer commutes. These costs may be borne by workers in the form of lost personal time or by firms in the form of lower productivity. The Commute Costs metric is calculated according to the following steps:

1. Vehicle Trips Per Day: The number of vehicles traveling the Focus Area per day is derived from BC Ministry of Transportation traffic data.
2. Travel Time Increase: A typical increase in travel time per trip that would result from temporary disruption is estimated. AECOM used travel time data from Google Maps to estimate the net increase in travel time required to reach Victoria by an alternate route from various points along Highway 14, north of the focus area (Shirley, Jordan River, and Port Renfrew). The assumed additional travel time required per trip is an average of these time estimates, weighted by the share of the population that lives in each of these communities, according to Census and CRD population estimates.
3. Increase in Commute Hours: The number of vehicle trips per day is multiplied by the additional travel time per trip to determine the total increase in commute hours per day resulting from the transportation disruption.
4. Daily Cost of Transportation Disruption: The Increase in Commute Hours output is multiplied by the average value of a person's time (assumed to be the average hourly wage in British Columbia) to yield the daily cost of the disruption.
5. Winter Impact: AECOM did not have access to data regarding the seasonality of traffic in the Focus Area. Therefore, winter impacts were not calculated for this indicator.

Table C1 summarizes the results of the commute costs calculation and the primary data sources.

Table C1 - Commute Costs Calculator

Commute impact area	# of passenger vehicles per day	Additional travel time per trip (hours)	Average value of a worker's time per hour	Cost of disruption / day
Highway 14, south of Shirley	1,348	1.6	$24.47	$52,776
Source:	BC Ministry of Infrastructure and Transportation 2012	AECOM Estimate, Google Maps	Statistics Canada 2014	

1.2 Private Transit Costs

The Private Transit Costs metric is defined as the daily cost of lost business revenue from service disruption borne by private transportation companies – in this case, the West Coast Trail Express, a shuttle bus service that runs from Victoria to the trailheads of the West Coast Trail[6]. The Private Transit Costs metric is calculated according to the following steps:

1. Number of Daily Passengers: The number of daily passengers was determined from a direct interview with the transit company. In this case, the West Coast Trail Express representative provided an estimate of annual passenger volume, which was converted to a daily figure. Note that the daily estimate is an average of the entire year, not only the months when the shuttle is in operation.
2. Transit Revenues: Passenger ticket costs are presumed to be the sole source of revenue, and are drawn from the West Coast Trail Express website. Full price, no-discount ticket prices are assumed.
3. Average Daily Cost of Service Disruptions: The business' estimate of average daily passengers is multiplied by the price per ticket to yield the average daily cost of service disruption on private transit revenue.
4. Winter Impact: The West Coast Trail Express only runs during the summer months. The winter daily impact is therefore zero.

Table C2 below, summarizes the results of the private transit costs calculation and the primary data sources.

Table C2 - Private Transit Costs Calculator

Private Transit impact	Average daily passengers	Price per passenger ticket	Cost of disruption / day
West Coast Trail Express (year round average)	10	$95	$950
West Coast Trail Express (winter)	0	$95	$0
Source:	West Coast Trail Express 2014a	West Coast Trail Express 2014b	

1.3 Emergency Services Costs

The Emergency Services Costs metric is defined as the daily cost of providing alternative emergency services to areas that are temporarily inaccessible by road. This metric relies on the assumption that emergency responders will reach residents of the focus area by airplane or helicopter during a storm event instead of by less expensive road transport. The Emergency Services Cost metric is calculated according to the following steps:

1. Number of Daily Emergency Response Events: The number of emergency response events per day in communities northwest of the Focus Area is determined by multiplying the daily number of emergency events per capita (as reported by BC Ambulance Services) by the population of communities impacted by the highway disruption. For purposes of this case study, impacted communities are defined as those communities immediately north of the Focus Area situated along Highway 14 whose route to Victoria would significantly change due to inundation of the Focus Area.

[6] For analysis of public transit costs in Focus Areas where public transportation is more prevalent, a similar calculation can determine the cost of service disruption to public transportation agencies.

2. Increase in Cost for Emergency Response: The increase in costs per emergency event for ground versus air services is determined by taking the difference between the unsubsidized fee for BC Ambulance emergency response by road and the average of helicopter and airplane response fees.[7]
3. Daily Cost to Provide Alternative Emergency Services: The number of emergency events per day in the focus area multiplied by the increase in costs per emergency for air response represents the daily cost to provide alternative emergency services.
4. Winter Impacts: Winter-only impacts were not calculated for this indicator.

Table C3 below, summarizes the results of alternative emergency services costs calculation and the primary data sources.

Table C3 - Emergency Services Costs Calculator

Alternative Emergency Services impact	Number of emergency response events per day	Additional cost per emergency event (air vs. ground service)	Cost of disruption / day
Service to Highway 14 communities, Shirley – Port Renfrew	0.25	$1,193	$298
Source:	AECOM analysis of BCAS Annual Report 2009 and CRD Population Estimates 2013	AECOM analysis of BCAS Fee Schedule 2014	

1.4 Tourism Costs

The Tourism Costs metric is defined as the daily costs of lost tourism spending caused by service disruption. Highway 14 is the primary thoroughfare from Victoria to reach popular tourist destinations such as the West Coast Trail and the Juan de Fuca Trail. This metric assumes that disruption of Highway 14 would deter tourists from traveling to destinations north of the Focus Area. The Tourism Costs metric is calculated according to the following steps:

1. Average Daily Visitors: Total average daily visitors to provincial and national parks north of the study area (i.e., from Shirley to the West Coast Trail) is determined using BC Provincial Parks and Pacific Rim Park data.
2. Average Tourist Spending per Visit: Average tourist spending per visit is drawn from prior economic studies of the parks and weighted according to the share of daily visitors who go to the provincial and national parks, respectively. The Bank of Canada's inflation calculator is used to adjust tourism spending figures to current prices.
3. Lost Tourism Spending: The number of daily visitors is multiplied by average daily tourist spending to determine the daily cost of lost tourism spending.
4. Winter Impacts: Winter Impacts exclude visits to the West Coast Trail, which is closed in the winter. Visits to the provincial parks were assumed to be constant (as seasonal data was not available at the time of the study).

[7] Fees are based on those charged to non-beneficiaries of the BC Medical Services Plan. These fees, according to BC Ambulance Services, represent the "unsubsidized cost of providing these services."

Table C4 below, summarizes the results of the tourism costs calculation and the primary data sources.

Table C4 - Tourism Costs Calculator

Tourism impact	Average Daily Visitors	Tourist spending per visit	Cost of disruption / day
BC provincial parks	1,188	$27.21	$32,325
West Coast trail	12	$158.88	$1,907
Total impact (year-round)	-	-	$34,232
Winter scenario (excludes West Coast Trail visitors)			$32,325
Source:	BC Provincial Parks 2013; Pacific Rim Park 2009	BC Ministry of Water, Land and Air Protection 2001; Canadian Parks Council 2009	

1.5 Fiscal Costs

The Fiscal Costs metric is defined as the daily cost of lost provincial tax revenue resulting from transportation disruption. The Fiscal Costs metric is dependent on the outcomes of the Tourist Costs and Transit Revenue Costs metrics. The Fiscal Costs metric is calculated according to the following steps:

1. Reduction in Business Revenue: The Tourist Costs and Transit Costs metrics are summed to arrive at a total reduction in local business revenue.
2. Reduction in Tax Revenue: The outcome of Reduction in Business Revenue is divided by 1 + goods and services (GST) and provincial sales (PST) tax rates to derive the pretax value of business sales.[8] The difference between pretax and final sales represents the daily loss in provincial sales tax revenue.[9]
3. Winter Impacts: The winter impacts calculation excludes sales related to the West Coast Trail, which is closed during the winter.

Table C5 - Fiscal Impacts Calculator

Fiscal impact	Lost tourist and transit revenue / day	Sales tax rate	Cost of disruption / day
Sales taxes (year round)	$35,087	12%	$3,759
Sales taxes (winter)	$32,325	12%	$3,463
Source:	Private Transit and Tourism indicators	BC Government 2014	

[8] Both prior metrics include sales tax in their outputs.

[9] *Other data inputs might not require this conversion, in which case business revenue would be multiplied by the sales tax rate to determine lost sales tax revenue.*

2. Community Disruption Case Study - Method[10]

2.1 Emergency Services

The Emergency Services Costs metric is defined as the daily cost of providing alternative emergency services to areas that are temporarily inaccessible by road ambulances. It is calculated in the same way as the Transportation Case Study's Emergency Services Metric. The metric is repeated here to illustrate how transportation impacts can be included among a broader set of community impacts. As described in the Transportation Case Study, the metric relies on the assumption that emergency responders will reach residents of the Focus Area by airplane or helicopter in the aftermath of a storm event instead of by less expensive road transport. The Emergency Services Cost metric is calculated according to the following steps:

1. Emergency Responses Per Day: The number of emergency response events per day in the focus area is determined by multiplying the daily number of emergency events per capita times the population of the Focus Area.
2. Emergency Response Cost Increase: The increase in costs per emergency event for ground versus air services is determined by taking the difference between the unsubsidized fee for emergency response by ambulance and the average of helicopter and airplane response fees.
3. Increase in Daily Costs to Provide Emergency Response: The number of emergency events per day in the focus area multiplied by the increase in costs per emergency for air response services represents the daily cost to provide alternative emergency services.

Table C6 below, summarizes the results of the Emergency Services metric and the primary data sources.

Table C6 - Emergency Services Costs Calculator

Alternative Emergency Services impact	Number of emergency response events per day	Additional cost per emergency event. air vs. ground service	Cost of disruption / day
Service to Oak Bay / Windsor Park	0.37	$1,193	$441
Source:	AECOM analysis of BCAS Annual Report 2009, BC Census 2011 and GIS parcel data	AECOM analysis of BCAS Fee Schedule 2014	

2.2 Commute Impacts

The Commute Impacts metric is defined as the daily cost of lost time per worker. As with Emergency Services, the Commute Impacts metric also appears as a metric in the Transportation Asset case study. As traffic count data were not available for the Oak Bay Windsor Park Focus Area, the Commute Impacts metric methodology was adjusted. The metric is thus an example of how methodologies may need to shift when conducting impact assessments in other Focus Areas. For this Community Impact Case Study, the Commute Costs metric is calculated according to the following steps:

1. Number of Daily Commuters: The number of daily commuters traveling from the Focus Area per day is determined by estimating the total number of workers who live in the Focus Area. This calculation is done by

[10] Winter-only *daily* impacts were not calculated for the Community Disruption case study, since indicator outputs are not significantly dependent on tourism.

multiplying the region's ratio of employment to working age population (79%, per Stats Canada 2014a) by an estimate of the Focus Area's working age population. The Focus Area population was estimated by multiplying the number of dwelling units times the number of people per dwelling unit reported by the Census. The working age population was determined by multiplying this output times the share of working age adults reported by the Oak Bay District for the neighborhood contained by the Focus Area.

2. Increase in Travel Time per Trip: A typical increase in travel time per trip that would result from road disruption during a storm event is assumed based on the Focus Area's characteristics. As the Focus Area is a relatively dense community close to downtown Victoria, AECOM conservatively assumed a 15 minute increase in commute times each way as a result of flooded roads. This is an illustrative figure assuming reduced capacity of existing travel routes, pending a more detailed traffic study.
3. Increase in Commute Hours: The number of daily commuters is multiplied by the additional, round-trip travel time per day to determine the total increase in commute hours per day of service disruption.
4. Cost of Commute Disruption: The Increase in Commute Hours output is multiplied by the average value of a person's time (assumed to be the average hourly wage in British Columbia) to yield the cost of the disruption.

Table C7 below, summarizes the results of the commute costs calculation and the primary data sources.

Table C7 – Commute Impact Calculator

Commute impact	Total workforce living in area	Additional round-trip travel time per day (hours)	Average value of a person's time per hour	Cost of disruption / day
Oak Bay / Windsor Park	577	0.5	$24.47	$7,059
Source:	AECOM analysis of GIS parcel data; Stats Canada 2014a; Oak Bay District 2010	AECOM Estimate, Google Maps	Statistics Canada 2014b	

2.3 Electric Utility Impacts

The Electric Utility Impacts metric is unique to the Community Disruption Case Study, and is defined as lost electric utility revenues per day from the disruption of electricity services, which may result from storm events. The economic cost is expressed in daily terms, though as more is learned about the likely length of utility disruption, the daily cost may be adjusted downward by the hours per day that a disruption is expected. Note that this quantitative metric only considers impacts from lost revenue due to disrupted service residential customers. Costs associated with restoring lost service are not considered. Disruptions to business customers are described qualitatively due to a lack of available data.

Table C8 summarizes the results of the utility impacts calculation and the primary data sources.

Table C8 – Electric Utility Costs Calculator

Residential Utility Impact	Daily utility spending per household	Number of homes in area	Cost of disruption / day
Oak Bay / Windsor Park – loss of residential electric service	$3.91	634	$2,479
Source:	AECOM analysis of BC Hydro 2013	GIS analysis	

2.4 Fiscal Risk

The final quantitative metric of Fiscal Risk is defined as residential property tax revenues at risk of decline in the event of severe storm events. This metric does not arrive at a daily operational cost and is therefore considered separately from prior quantitative methods and excluded from the calculation of gross economic impact. The Fiscal Risk metric assumes that with an increase in storm events, residential property values may decrease in response to the risk of property damage and/or increases in insurance premiums and reductions in coverage, thus impacting tax revenues. Tax revenue from other properties (commercial, industrial) and other tax revenues (e.g. school taxes) have not been included within the scope of this Fiscal Risk metric. Fiscal Risk is calculated according to the following steps:

1. Residential Property Values: The aggregate value of land and improvements in the Focus Area was determined through GIS parcel data.
2. Property Tax Value Decline Risk: The aggregate value of residential property is multiplied by the applicable local property tax rate to derive total property tax revenues at risk of decline.

Table C10 summarizes the results of the fiscal impacts calculation and the primary data sources.

Table C10 – Property Tax Impact Calculator

Fiscal impact	Aggregate value of residential land and improvements in focus area	Local residential property tax rate per dollar of property values	Annual property tax revenues at risk
Property taxes – Oak Bay / Windsor Park	$263,000,000[11]	0.00596	$1,567,480
Source:	GIS	BC Ministry of Community Development 2014	

3. Business Disruption Case Study - Method

3.1 Productivity Costs

The Worker Productivity Cost metric is defined as the daily cost of wages paid by disrupted business establishments. In many cases these costs will be borne by firms, as wages may still be paid to employees when

[11] *Based on AECOM analysis using 2013 data. This differs slightly to the subsequent analysis by CRD reported in section 3.6, which was based on an updated cadastral data layer and 2014 BC Assessment data.*

business is disrupted by an inundation event. Because wages paid during a disruption represent a loss in productivity, these costs could eventually lead firms to reduce staffing or wages, ultimately impacting employees as well as their firms. Estimating worker productivity costs requires an understanding of firms' existing staffing, which was not possible to identify through publically available data in the cases of Harbour Air and Victoria Clipper. In a phone interview with AECOM, Harbour Air provided an estimate of their total workforce based at the Inner Harbour; Victoria Clipper was contacted by AECOM but chose not to participate in this analysis. *AECOM understands that the CRD may have access to an employer database that can provide more accurate estimates of total employees by firm. In future rounds of analyses, the CRD may wish to draw on this database to estimate economic impacts.*

The Worker Productivity Costs metric is calculated according to the following steps:

1. Number of Workers: The number of workers is determined for each major firm in the Focus Area. This is done, where possible, through the review of an existing economic impact study, or through primary research. Note that employee totals are annual averages and do not take into account seasonality in the workforce. Employers were asked to report employment data only for Inner Harbour establishments; the CRD may wish to verify whether these estimates are accurate based on its employer database.
2. Daily Wages: The number of workers is multiplied by the average daily industry-specific wage reported by BC Statistics to arrive at the total daily wages of potentially impacted firms. In this case, the average wage for the transportation industry is used.
3. Winter Impacts: Winter employment at Blackball Ferry is reduced proportional to the estimated reduction in ticket sales during the winter (see Revenue Indicator). Employment for Harbour Air is held constant as seasonal passenger data was not available at the time of this study. Daily wages at both firms are assumed to be constant.

Table C11 below, summarizes the results of the productivity costs calculation and the primary data sources.

Table C11 - Productivity Costs Calculator

Lost Productivity	Average daily industry wage	Number of workers	Lost wages per day of disruption
Blackball Ferry	$217	61	$13,237
Victoria Clipper Ferry	$217	NA	NA
Harbour Air	$217	100	$21,700
Total (year round impacts)		161	$34,937
Blackball Ferry (winter)	$217	25	$5,323
Total (winter impacts)		125	$27,023
Sources:	*BC Stats 2014*	*Tourism Victoria 2007; Harbour Air 2014a*	

3.2 Revenue Costs

The Business Revenue Costs metric is defined as the daily cost of lost revenue of disrupted business establishments during a storm event. As firms were generally not willing to share revenue data, this metric relies on reported passenger and fare data to approximate business revenue. Alternative methodologies (such as an estimate

of revenue per employee) would have to be developed to apply this metric to other Focus Areas where transportation is not the dominant industry. Of the two firms without a publically available impact study, Harbour Air provided a passenger estimate; Victoria Clipper Ferry did not. As with the productivity matrix, Victoria Clipper is excluded from the calculation because of lack of data. The Business Revenue metric is calculated according to the following steps:

1. Number of Daily Passengers: The number of daily passengers is determined for each transportation business based on interviews or a publically available economic impact study. Daily passengers represent annual averages.
2. Lost Daily Revenues: The daily passenger volume is multiplied by current passenger fees to estimate, by an order of magnitude, the lost business revenue per day of disruption. Where prices vary by destination (in the case of Harbour Air), rate information for the most common route is used. Where prices vary by fare type (auto or passenger) posted fares were weighted according to the share of passengers boarding by foot or auto. *Note that other forms of passenger revenue, such as food and beverage sales, are excluded from this preliminary economic analysis.*
3. Winter Impacts: Blackball Ferry's winter impact is estimated according to January – March ridership data. Harbour Air's impact is assumed to be constant (as seasonal data was not available for this preliminary study).

Table C12 below, summarizes the results of the productivity impacts calculation and the primary data sources.

Table C12 – Revenue Impact Calculator

Lost Revenues	Number of daily passengers (inbound and outbound)	Revenue per passenger	Lost revenue per day of disruption (estimated)
Blackball Ferry	1,124	$51	$57,324
Victoria Clipper Ferry	NA	$83	NA
Harbour Air	685	$157	$107,545
Total (year round impacts)			$160,373
Blackball Ferry (winter)	456	$51	$23,051
Total (winter impacts)			$130,596
Sources:	*Tourism Victoria 2007; Harbour Air 2014a*	*Blackball 2014; Clipper 2014; Harbour Air 2014b*	

3.3 Tourism Costs

The Tourism Costs metric is defined as the daily cost of lost ancillary tourist spending. All three of the major businesses in the Focus Area are patronized by tourists, who rely on plane or ferry service to reach destinations in the Capital Regional District. The Tourism Costs metric assumes that in the event of a disruptive storm, spending by

tourist customers would decline. Business proprietors are generally unaware of how much their customers spend in the regional economy, unless they have conducted an economic impact study. Tourism Victoria's impact study of Blackball Ferry Blackball Ferry from 2007 was used to estimate the spending behavior of its passengers; Harbour Air is currently undertaking a similar study that will not be available until October 2014. For Victoria Clipper, an estimate of spending per passenger is publically available (in the Blackball impact study) but Victoria Clipper's total passenger volume is not. Consequently, Victoria Clipper and Harbour Air are excluded from this metric's calculation, pending the availability of required data inputs.

The Tourism Costs metric is calculated according to the following steps:

1. Number of Daily Passengers: The number of daily passengers (inbound only) is determined from available data.
2. Share of Passengers Who Are Tourists: The share of passengers considered tourists is determined from available data.
3. Average Spending per Passenger: The average spending per passenger is determined from available data.
4. Lost Daily Tourism Spending: The lost ancillary tourism spending per day of disruption is calculated by multiplying daily passengers times the share who are tourists times average spending per tourist.
5. Winter Impacts: Blackball Ferry's winter impact is estimated according to January – March ridership and January – March per capita tourism spending, as reported in the 2007 economic impact study.

Table C13 below, summarizes the results of the tourism costs calculation and the primary data sources.

Table C13 – Tourism Costs Calculator

Tourism Impact	Number of daily passengers (inbound)	Share of passengers considered tourists	Average spending per passenger	Lost tourism spending per day of disruption
Blackball Ferry	562	85%	$402	$192,035
Blackball Ferry (winter)	228	85%	$237	$45,598
Victoria Clipper Ferry	NA	NA	$294	NA
Harbour Air	342	NA	NA	NA
Total (year round)				$192,035
Total (winter)				$45,598
Sources:	*Tourism Victoria 2007; Harbour Air 2014a*	*Tourism Victoria 2007*	*Tourism Victoria 2007*	

3.4 Fiscal Costs

The final metric, Fiscal Costs, is defined as the provincial tax revenue lost daily resulting from the service disruption. The Fiscal Costs metric is dependent on the outcomes of the Tourist Costs and Business Revenue Costs metrics. The Fiscal Costs metric is calculated according to the following steps:

1. Lost Business Revenue: 100% of Tourist Spending (above) is assumed to be taxable by the provincial sales tax (PST) and the goods and services sales tax (GST). The majority of Business Revenue output is

assumed to be taxable only by the goods and services (GST) tax. A 50% factor is applied to business revenue of Blackball Ferry on the basic assumption that only half of its passenger ticket sales are taxed locally. (In other words, Port Angeles in the United States is the point of sale for the remaining ticket sales).

2. Lost tax Revenues: The Lost Business Revenue output is divided by 1 + the applicable tax rate to derive the pretax value of business sales.[12] The difference between pretax and final sales represents the daily loss in applicable sales taxes.
3. Winter Impacts: Daily Winter Impacts follow the same methodology but based on winter-only Tourism Spending and Business Revenue estimates, calculated above.

Table C14 - Fiscal Costs Calculator

Fiscal impact	Local share of lost tourist and transit revenue / day	Sales tax rate	Cost of disruption / day
Tourism sales taxes – goods and services (year round)	$192,035 (A)	12% (B)	20,575
Transportation sales taxes (year round)	$160,373	5%	$7,637
Total sales taxes (year round)			$28,212
Sales taxes – goods and services (winter)	$45,598	12%	$4,886
Sales taxes – transit only (winter)	$130,596	5%	$6,219
Total sales taxes (winter)			$11,105
Source:	Business Revenue and Tourism indicators	BC Government 2014	A – [A / (1 + B)]

[12] Tourism and Business Revenue metrics include sales tax in their outputs.

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