Shoreline Erosion and Sea Level Rise

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What is happening?

Globally, sea level continues to rise and pose risks to coastal communities.[1] Sea level rise (SLR) is caused by thermal expansion as ocean waters warm and increasing global temperatures melt ice caps and glaciers. Exactly how much sea level will rise is unpredictable due to various uncertainties, such as the amount of greenhouse gases produced, whether countries meet their carbon emission reduction goals, or even if a region is experiencing tectonic uplift.

The Government of B.C. recommends planning for a SLR of approximately 1 m by 2100, and 2 m by 2200[2]; however, SLR exceeding 1 m by 2100 could be possible.[1] Figure 1 shows the sensitivity of the shorelines in Átl'ka7tsem/Txwnéwu7ts/Howe Sound to SLR. Sea Level Rise is causing concern for waterfront property owners and communities within Átl'ka7tsem/Txwnéwu7ts/Howe Sound due to higher waters encroaching on properties and carrying away shoreline materials such as sand and pebbles, a process known as shoreline erosion. Sea Level Rise is a relatively slow process and therefore the effects from storm surges (Figure 2) will be seen before the direct impacts of SLR are noticed.

During the winter of 2018/2019, several severe storms battered Átl'ka7tsem/Txwnéwu7ts/Howe Sound. This caused storm surges resulting in shoreline erosion, damage to infrastructure, loss of property, endangerment of lives that necessitated emergency services attendance, and high economic costs to clean up the damage and subsequent mitigation (see Comprehensive Planning, Ocean Watch Átl'ka7tsem/Txwnéwu7ts/Howe Sound Edition [OWHS] 2020). Many of these issues were raised in Shorelines and Sea Level Rise, OWHS 2017.

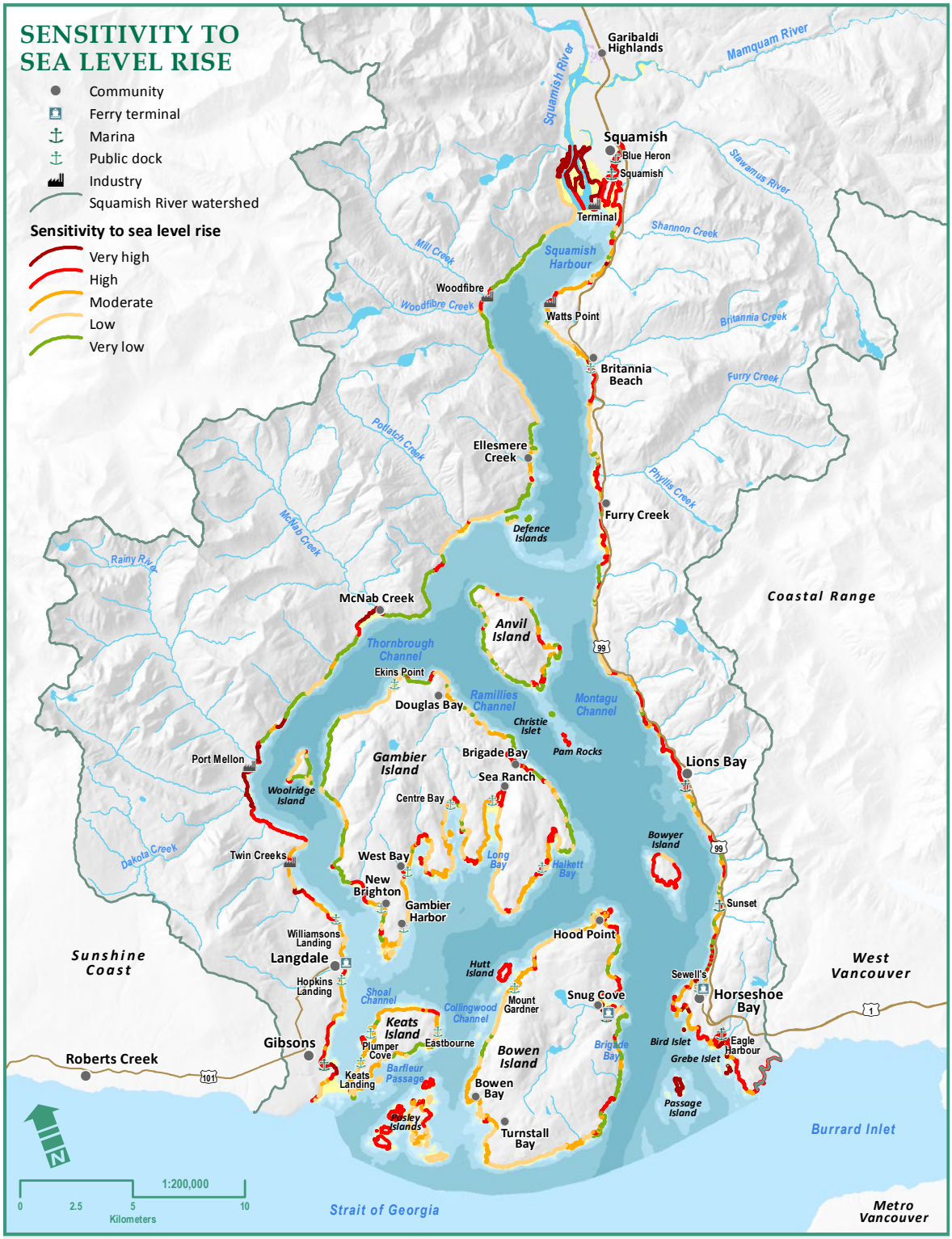

Figure 1. Sensitivity to sea level rise in Átl'ḵa7tsem/Txwnéwu7ts/Howe Sound.[3]

What is a storm surge?

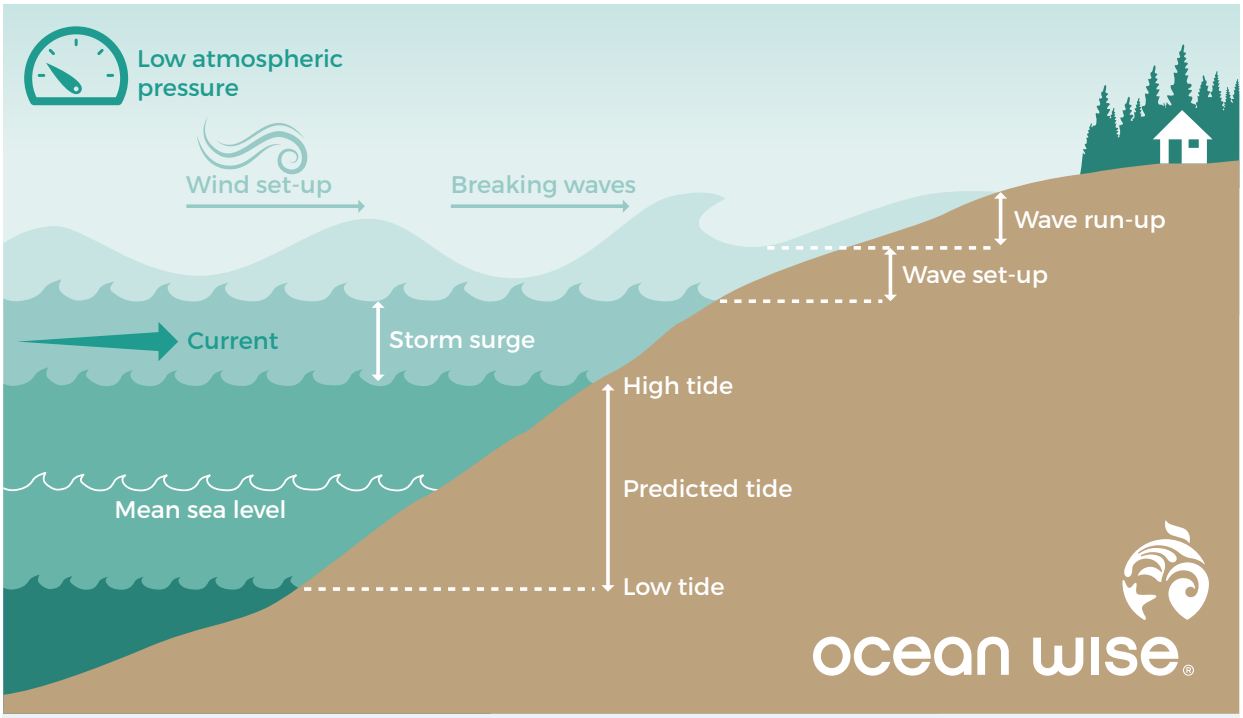

Figure 2. Factors that contribute to the creation of a storm surge.

To combat damage caused by SLR, communities often opt for hard armouring of shorelines, such as shoreline fortification made from rubble and rocks (also known as rip rap), seawalls, or dikes. However, an unintended consequence of such an approach is the erosion of the shoreline, including the sensitive habitats found in these areas (see Shorelines and Sea Level Rise, OWHS 2017). By contrast, use of soft armouring, such as placing sand and gravel along shorelines, building dunes, constructing wetlands, revegetating or preserving shoreline vegetation, and/or constructing offshore reefs, can help mitigate wave energy and allow the natural landward migration of the shoreline. Specialized habitat, such as eelgrass beds and fish spawning areas, are thus not lost to erosion but gradually migrate inland along with the shoreline.[4]

A storm surge refers to a temporary increase in the height of the sea due to extreme meteorological conditions such as low atmospheric pressure and/or strong winds. A storm surge is independent of a high tide, but its impact may be magnified during a high tide.

(FROM BC MoE 2013)

What is the current status?

Awareness of and interest in the Green Shores approach has continued to grow throughout Átl'ka7tsem/Txwnéwu7ts/Howe Sound. The number of queries received by Green Shores has increased over the past few years, from both communities and private landowners throughout the Sound (approximately five to six queries per year).[5] Incentives to further increase the use of Green Shores are being considered, such as shoreline assessments, project design guidance from a professional on the application of Green Shores and fast-tracked permitting for projects that use a nature-based approach.

Green Shores delivers educational workshops in communities, with considerable ongoing education and outreach for communities and individuals to learn about shoreline erosion mitigation. In 2018, two one-day workshops were given in Átl'ka7tsem/Txwnéwu7ts/Howe Sound and the Strait of Georgia – one each on Nexwlélexwem/Bowen and Thormanby Islands. Additionally, Green Shores is working with British Columbia Institute of Technology (BCIT) to develop a course for biologists, coastal engineers, planners, and landscape architects to gain an approved professional designation to ensure they have the necessary skills to design projects to effectively use Green Shores in their designs to mitigate shoreline erosion. This course should be available by the end of 2020.

For more than five years, the Gambier Island Local Trust Committee (GLTC) has made shoreline protection and stewardship a priority project. Over the last two years, the GLTC has been exploring updating policy and regulatory options to align with provincial guidelines, with a focus on Lehk'tines/Keats Island, using a two-phase approach.

A Green Shores project on an eroding shoreline in Qualicum Bay, Vancouver Island. Left – before restoration. The red line encircles a failing wooden bulkhead where erosion was beginning to undermine the structure. Plants were non-native species. Right – after restoration. The wooden bulkhead was removed, and the shore was regraded to a more natural slope. Large boulders were placed at ~1 m depth and infilled with smaller rock, sand and gravel, to provide a growing medium for native plants. Logs were buried along the upper portion of the shore to mimic the natural shoreline and provide shelter for plants to grow (Photo credit: Green Shores).

Phase 1 involved community engagement and the introduction of potential policy, regulation or voluntary stewardship options (e.g., increasing setback distances of buildings from the natural boundary of the sea). A survey to gauge the community's values in relation to the shoreline (e.g., protect, recreate) was circulated. This phase was completed in 2018.

Phase 2 began in 2019 with the establishment of a working group consisting of eight community members. The purpose of Phase 2 is to review and update the relevant Official Community Plan policies and land use bylaw regulations to:

- address sea level rise and flooding;
- protect archaeological sites/resources, which are predominantly found along shorelines;
- protect sensitive ecosystems, such as eelgrass beds;
- protect shoreline integrity and function;
- preserve public access to the foreshore; and
- ensure consistency with First Nations-led marine planning initiatives.[6]

Other municipalities throughout the Sound have been pursuing options to both protect their shorelines from erosion and SLR as well as to restore, enhance and protect ecosystem functions. For example, the West Vancouver Shoreline Preservation Society has been investigating options to protect shorelines for private landowners. In 2018, Bowen Island Municipality (BIM) released a parks plan, which acknowledges the importance of shoreline erosion by including a recommendation to protect shorelines and enhance marine habitat adjacent to land owned by BIM.[7]

What are the potential impacts of climate change on shoreline erosion?

Shoreline erosion is an indirect impact of climate change. The frequency and intensity of storms and storm surges is predicted to increase due to climate change.[8,9] Without appropriate planning, storms and storm surges will lead to greater shoreline erosion, increased infrastructure damage, loss of sensitive habitat, loss of property, economic losses and an increased risk of loss of life, not to mention impacts to species that use shorelines for habitat.

What has been done since 2017?

The table below reports on progress made on recommended actions from the previous 2017 article, where identified. Many of these require ongoing action.

2017 ACTION	ACTION TAKEN
Adopt Green Shores approach as a policy. Use Green Shores approaches for protecting and enhancing public shorelines in communities. Join the Green Shores Local Government Working Group for Green Shores support and resources.	These actions are addressed by the following: The number of queries received by Green Shores has increased over the past few years, from both communities and private landowners throughout the Sound. These have not translated into enrolled projects.

What can you do?

A detailed overview of recommended actions relating to climate change is included in *The path to zero carbon municipalities* (OWHS 2020). In some cases, no progress was identified on previous recommended actions; these remain listed below. Additional actions marked as NEW also follow.

Individual and Organization Actions:

- Educate yourself on how to care for your shoreline using the resources provided below.

Government Actions and Policy:

- NEW Identify areas at high risk for shoreline erosion, flooding and landslides.
- NEW Limit and manage development in these areas, e.g., building restrictions, setback limits.
- NEW Incentivise or offset costs of shoreline stabilization of public assets, e.g., soft shore armouring.

Methods

Information on severe storms in Átl'ka7tsem/Txwnéwu7ts/Howe Sound during the 2018/19 winter season was presented at the Ocean Watch Howe Sound/Atl'ka7tsem Workshop held on June 7, 2019 (presenter: Ruth Simons). Information on Green Shores was sourced from DG Blair, Executive Director of the Stewardship Centre for BC. Information regarding GLTC was provided by Jaime Dubyna, Planner, Islands Trust, and relevant websites. Other information on various municipalities was sourced from relevant websites, as shown in the References and Resources. Information regarding climate change impacts on shoreline erosion was accessed on google using the search string "climate change AND Vancouver AND storm." The most relevant resources were used.

Resources

This list is not intended to be exhaustive. Omission of a resource does not preclude it from having value.

DFO Guide for Property Owners:
Shoreline Care, https://www.csrd.bc.ca/sites/default/files/swmp/Shoreline%20Care.pdf

Islands Trust:
Marine Protection Tools for Local Governments, http://www.islandstrust.bc.ca/trust-council/advocacy/marine-environment/

A Landowner's Guide to Protecting Shoreline Ecosystems, http://www.islandstrust.bc.ca/media/282417/Landowners-Guide-September-draft-revised.pdf

Islands Trust Conservancy:
Caring for our Shorelines, http://www.islandstrustconservancy.ca/initiatives/marineconservation/

Stewardship Centre for BC:
Green Shores resources, https://stewardshipcentrebc.ca/?cat=&s=shoreline

References

1 Bush E, Lemmen D. Canada's Changing Climate Report [Internet]. Ottawa: Government of Canada; 2019. p. 444. Available from: www.ChangingClimate.ca/CCCR2019 ISBN: 978-0-660-30222-5

2 BC Ministry of Environment. Sea level rise adaptation primer. A toolkit to build adaptive capacity on Canada's south coasts. [Internet]. 2013. p. 152. Available from: https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/resources/slr-primer.pdf

3 Beaty F, van Riet W, Wareham B, Schultz J. Howe Sound/Atl'ka7tsem Map [Internet]. Ocean Wise and David Suzuki Foundation; 2019. Available from: http://howesoundconservation.ca

4 Green Shores. Protecting waterfront properties and natural shoreline habitats [Internet]. 2019. Available from: http://stewardshipcentrebc.ca/Green_shores/

5 DG Blair, Stewardship Centre BC, personal communications.

6 Islands Trust. Keats Shoreline Project Phase 2 [Internet]. 2019. Available from: http://www.islandstrust.bc.ca/islands/local-trust-areas/gambier/projects-initiatives/keats-island-shoreline-protection-phase-2/

7 Bowen Island Municipality. Bowen Island Parks Plan [Internet]. 2018. p. 197. Available from: https://bowenisland.civicweb.net/document/155270

8 Metro Vancouver. Climate change around the globe: Climate 2050 [Internet]. 2019. Available from: http://www.metrovancouver.org/services/air-quality/climate-action/climate2050/learn/global/Pages/default.aspx

9 City of Vancouver. Climate change adaptation strategy [Internet]. 2019. Available from: https://vancouver.ca/green-vancouver/climate-change-adaptation-strategy.aspx

Additional Resources

Bowen Island Municipality 2018. Bowen Island Parks Plan. 197pp. Available from: https://bowenisland.civicweb.net/document/155270 Accessed on August 29 2019.

BC Ministry of Environment 2013. Sea level rise adaptation primer. A toolkit to build adaptive capacity on Canada's south coasts. 152pp. Available at: https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/resources/slr-primer.pdf Accessed August 23 2019.

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District of West Vancouver Shoreline Protection Plan 2012. Available from: https://westvancouver.ca/sites/default/files/shoreline-protection-plan.2012-2015.pdf Accessed August 29 2019.

Green Shores 2019. Protecting waterfront properties and natural shoreline habitats. Available at: https://stewardshipcentrebc.ca/programs/ Accessed on August 23 2019.

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Metro Vancouver 2019. Climate change around the globe: Climate 2050. Available at: http://www.metrovancouver.org/services/air-quality/climate-action/climate2050/learn/global/Pages/default.aspx Accessed on August 22 2019.