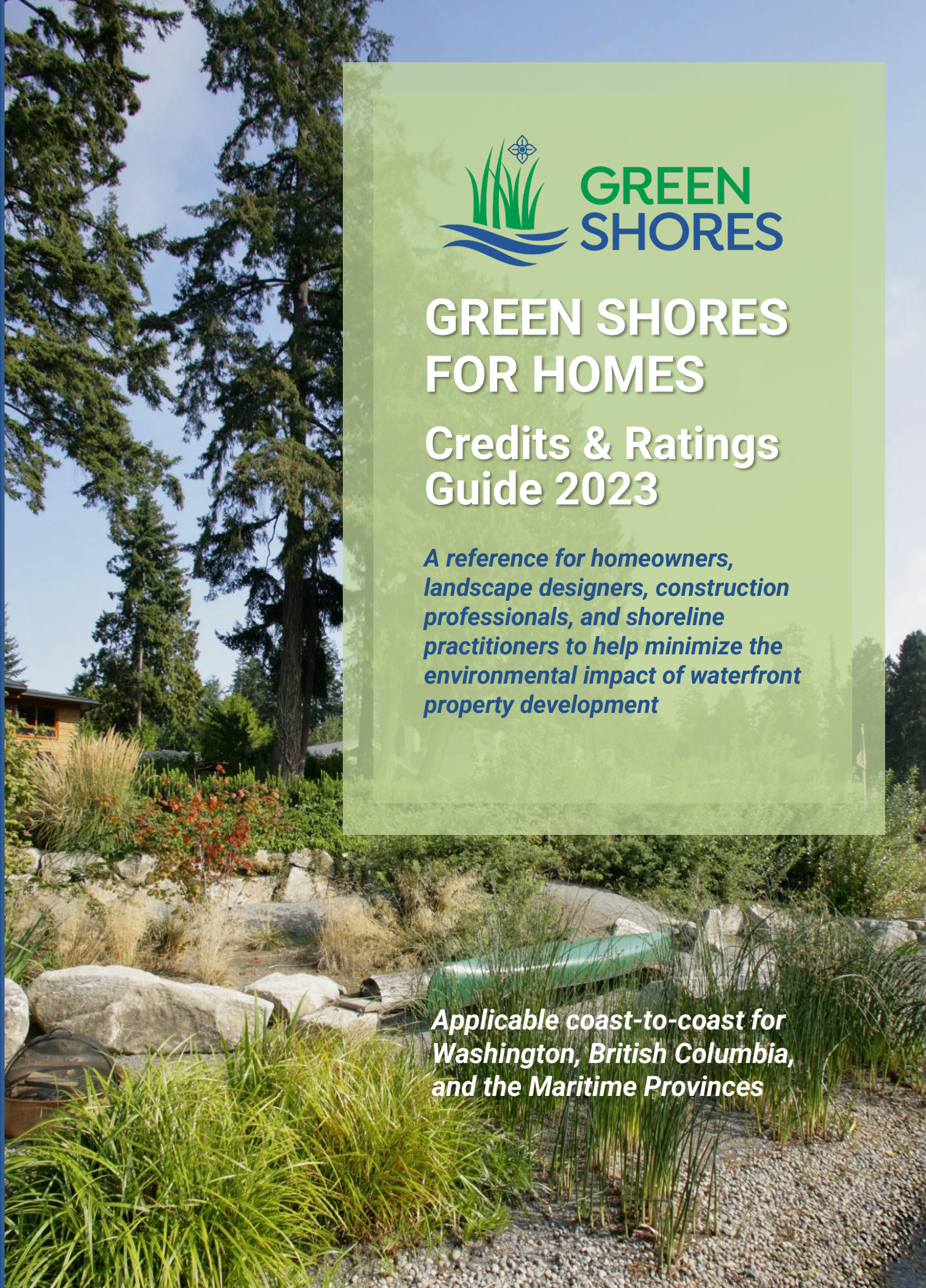

GREEN SHORES

GREEN SHORES FOR HOMES

Credits & Ratings Guide 2023

A reference for homeowners, landscape designers, construction professionals, and shoreline practitioners to help minimize the environmental impact of waterfront property development

Applicable coast-to-coast for Washington, British Columbia, and the Maritime Provinces

For more information regarding Green Shores contact:

Stewardship Centre for BC
info@stewardshipcentrebc.ca

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STEWARDSHIP CENTRE
FOR BRITISH COLUMBIA

Green Shores® for Homes

Credits and Ratings Guide

A reference for homeowners, landscape designers, construction professionals, and shoreline practitioners to help minimize the environmental impact of waterfront property development

UPDATED 2023 by TransCoastal Adaptations Centre for Nature-Based Solutions at Saint Mary's University

for the Stewardship Centre for British Columbia

GREEN SHORES IS A PROGRAM OF THE

STEWARDSHIP CENTRE FOR BRITISH COLUMBIA

https://stewardshipcentrebc.ca/

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Contents

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Introduction

People love to live in places where water and land meet. Shorelines provide work, recreation, living space, mild climates, and wonderful views. People are not the only creatures drawn to shorelines. Due to their diverse resources and habitats provided by shorelines, they are biologically rich and productive habitats for many varieties of wildlife. In fact, scientists continue to highlight the critical value that shorelines provide to important wildlife species such as juvenile salmon on the west coast of North America, and Piping Plover on the east coast.

Unfortunately, many of the natural features that make shorelines so attractive are often the casualty of human activities. Native trees, shrubs, and grasses are cleared to make way for houses, lawns, and views. Bulkheads, docks and piers displace beaches and alter natural shoreline processes. Loss of shoreline vegetation allows contaminants to flow directly into the water. Prime wildlife habitats disappear, taking with them birds, mammals, fish, and beneficial insects.

The good news is that researchers and professionals are finding new strategies for protecting waterfront properties while also protecting and restoring habitats. Instead of concrete and sheet pile, new practices use a combination of plantings, gravel, sand, logs, stones, setbacks, and slope modification to protect against shoreline erosion and provide recreational access while at the same time maintaining the ecological attributes of the shoreline.

Adapted from Green Shorelines, City of Seattle, 2011

Green Shores for Homes Gold project, near the City of Nanaimo, BC (photo credit: Kelly Loch)

Introduction

Green Shores® is an initiative of the Stewardship Centre for BC (SCBC). The program promotes sustainable shoreline ecosystems for residential, commercial, institutional and park properties. The program promotes sustainable shoreline ecosystems for residential, commercial, institutional, and park properties in Canada and the United States. It aims to build property owner capacity to manage natural hazards in a way that minimizes the impacts of shoreline development and preserves or enhances shoreline ecosystem services in the context of a changing climate. Climate change is impacting the rate and nature of change across North American shorelines and affecting its ecosystems. Green Shores incentivizes and provides a guideline for climate change adaptation and incorporates the most recent estimates of sea/water level rise[1] to increase shoreline resilience for both ecosystems and property developments. The Green Shores (GS) guiding principles are to:

1. Preserve or restore physical processes – the natural actions of water and sediment movement that maintain healthy shorelines.

2. Maintain and enhance shoreline habitat diversity and function along the shoreline.

3. Prevent and reduce pollutants entering the aquatic environment.

4. Avoid or reduce cumulative impacts – small individual effects that add up to large impacts on shoreline environments.

[1] James et al., 2021; Bush, E. and Lemmen, D.S. 2019 ; Han et al. 2016; James et al. 2014, IPCC 2014.

Introduction

How does Green Shores benefit homeowners?

- Increases accessibility of shorelines, eliminating drop-offs and walls, and creating opportunities for strolling, kayaking, foraging and simple beach fun.
- Beautifies shorelines by adding native vegetation and creating habitat for fish and wildlife.
- Minimizes shoreline erosion and flooding, with alternatives to costly bulkheads/seawalls.
- Offers financial benefits such as technical assistance, reduced permit fees, expedited permit approvals, or tax incentives, similar to other "green" programs like LEED®, Built Green® and Sustainable Sites®.

How does Green Shores benefit the environment?

- Preserves and restores physical processes—the natural actions of water and sediment that maintain healthy shorelines. "Immobilizing" bulkheads and rock embankments can disrupt these natural actions.
- Preserves and enhances shoreline ecology, including both plant and animal communities and their habitats, and biodiversity.
- Prevents or reduces pollution of the aquatic environment.
- Reduces cumulative impacts: the small individual actions that add up to large impacts on shoreline environments.

Green Shores was initiated in 2005 by SCBC, with support from multiple funding partners, to address coastal shore stewardship. Green Shores provides science-based tools and best practices guidelines for:

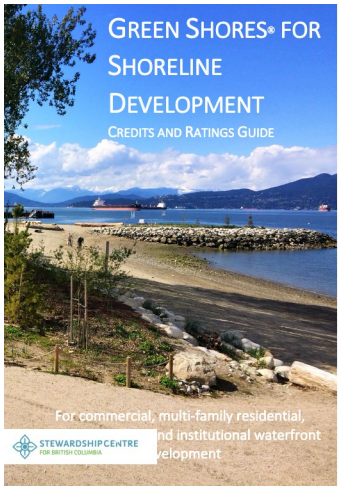
- Property owners
- Industry professionals practicing in the planning, engineering, landscape architecture, and ecological restoration fields
- Construction contractors
- Conservation organizations
- Local governments

A note on terminology

This guide uses the term "shoreline" to refer to both marine and lake shore environments.

Green Shores has evolved since 2005 to include two programs. The first is called Green Shores for Homes (GSH) - described in this guide - which is oriented to waterfront homeowners. The second is called Green Shores for Shoreline Development (GSSD) which is oriented towards larger development projects.

Green Shores Training and Project Enrolment



The Green Shores program recognizes that larger scale waterfront developments provide their own unique challenges and require a separate rating system than generally smaller homeowner projects. Green Shores® for Shoreline Development (2020, left image) has been developed for use on subdivisions and multi-family residential development projects, commercial waterfront development projects, waterfront infrastructure development (such as public walkways) and shore design including shore protection works in public spaces (parks and recreational areas). More information on Green Shores for Shoreline Development is available online at https://stewardshipcentrebc.ca/green-shores-home/gs-programs/gssd/.

To fulfill its vision, the Green Shores program also offers education and training (including a registry for Green Shores Approved Professionals), support for local governments who wish to bring Green Shores to their community through a dedicated working group, and shoreline project enrolment and ratings for projects both large and small. For further information on accessing training in BC, connecting with a Local Government Working Group, or enrolling a project go to https://stewardshipcentrebc.ca/green-shores-home/. For information regarding training, the Local Government Working Group, and enrolling a project in the Maritime provinces, go to https://www.transcoastaladaptations.com/green-shores.

Overview of Green Shores for Homes

Green Shores for Homes (GSH) is a program that focuses on positive steps to reduce the impact of residential development on shoreline ecosystems and helps waterfront homeowners restore natural shorelines and enjoy the many benefits they bring.

Geographic Scope

Green Shores for Homes was originally developed and piloted in Washington State and British Columbia for both lake and marine environments. The program and rating system have since been expanded to the Maritime provinces of Canada. While information on Washington state is included whenever possible, any reader looking to apply this guide in Washington should check their local regulatory requirements for implementing projects in the United States of America.

Understanding Shore Zone Jurisdiction and Rules

Different areas of the shore zone may fall under different levels of government or the jurisdiction of Indigenous Tribes or First Nations and corresponding regulations. Regulations also often differ from one region to another given the local government context. When designing a project along a shoreline, work often requires consultation and approval of designs from various government bodies. For example, the Federal *Fisheries Act* in Canada provides the federal government with jurisdiction of marine and some freshwater landscapes, often with permit application requirements for projects, while local governments may enact their own regulations around small-scale work or environmentally sensitive areas that require their own unique permit applications, like this watercourse alterations guide from Nova Scotia: https://novascotia.ca/nse/watercourse-alteration/docs/NSE-Watercourse-Alteration-Program-May29.pdf. Planning and design professionals can help navigate shoreline regulations and pursuing the GSH program can also aid in the approval process, but adherence to applicable regulations will always be a prerequisite of the program.

The GSH Rating System

The GSH Rating System has been created as a tool for waterfront homeowners, their consultants, and contractors to develop their properties in a shore-friendly way that meets the Green Shores guiding principles. It applies to all types of shorelines in both marine and lake environments—from rocky, to sand and gravel shores, estuaries to mudflats, rock cliffs to coastal bluffs.

The GSH Rating System is built on a format similar to green building rating programs such as Built Green® and LEED®. A homeowner can use the Green Shores for Homes guide to improve their shoreline project design and then once complete, the project is assessed against a series of credits for which it can achieve points.

There are four prerequisites that all shoreline projects must complete in order to apply for a GSH rating. These requirements provide the baseline information for all the credits, and consist of:

- **An existing conditions plan:** Show existing site conditions and shoreline processes that will affect your project.
- **A site design plan:** Show the project in the context of the existing site conditions and processes.
- **An environmental management plan for construction:** Minimize site disturbance and address sediment and pollutant control on your site.
- **Critical or sensitive habitat identification:** Avoid disturbing or destroying these vital habitats.

There are twenty-three credits for which points may be achieved. The credits are organized under four categories:

- **Shoreline physical processes:** Protect or restore natural physical processes that are vital to the health of shoreline environments.
- **Shoreline habitat:** Protect, restore, and enhance aquatic and riparian habitats.
- **Water quality:** Eliminate or significantly reduce sediment, chemical and organic pollutants discharged to lakes and marine waters in rainwater runoff and/or on-site sewage treatment.
- **Shoreline stewardship:** Adopt general best management practices that help to support public values of shorelines.

The GSH credit and rating system does not include a specific credit or requirement for projects to address predicted sea level rise (SLR) associated with climate change. SLR is referenced in Credit 1.2 Setback/Impact Avoidance as one of its Basic Points options, and in Credit 1.6 Managed Retreat as a bonus point. Both these credits address potential effects of SLR on structures but not on the shoreline itself.

Although Green Shores approaches can be used to address SLR, the GSH Guide and rating system does not attempt to address the more complex coastal engineering needed to fully deal with SLR effects. Nor does the program provide the associated expertise to verify that any given project rated under the GSH system will protect adequately against SLR. Both the design and verification for projected SLR require a

higher level of coastal expertise. Various levels of governments are developing guidance and regulations that address projected SLR.[2] Applicants are encouraged to meet or exceed such guidance.

Monitoring is an important part of assessing the effectiveness of Green Shores projects and the GSH program. The purpose of monitoring is to observe the effect of an action to assess whether that action has a positive, negative or neutral contribution to the goals of the project. Monitoring can also indicate whether a project is having the desired effect on ecological or physical processes and will help inform maintenance and management actions. Adaptive management, which involves monitoring the effects of an action (e.g., nature-based methods), identifying any undesired effects and their causes, and making corrections in response to those observations, is the most effective approach in dynamic systems like shorelines and in the face of the uncertainties of climate change and sea level rise. Adjustments made in a timely and consistent manner using the adaptive management approach are often more effective and usually less costly than major repairs further down the road. Monitoring bonus points are available for 7 of the credits; in order to earn points for monitoring, applicants must agree to complete the required activities in the three years after construction.

Credit Rating Levels

It is important to realize that out of the 23 credits available, most shoreline projects will qualify for only 5 to 10 credits. Getting a GSH rating however, is dependent not on the number of applicable credits, but on how many points the project gets for the credits that do apply to your project.

A shoreline project may achieve either of two GSH rating levels based on the number of points achieved:

GSH Silver The project results in recognizable improvement and/or conservation of the natural features and processes of the shoreline.	*20-39 points of which a minimum of 10 points (collectively) are acquired from Shoreline Processes and Shoreline Habitat credit categories.*

GSH Gold The project exhibits exceptional design regarding improvement/conservation of the natural features and processes of the shoreline.	*Minimum 40 points of which a minimum of 20 points (collectively) are acquired from Shoreline Process and Shoreline Habitat credit categories.*

[2] In Canada, see the Canadian Centre for Climate Services, https://www.canada.ca/en/environment-climate-change/services/climate-change/canadian-centre-climate-services.html.

The GSH Rating Process

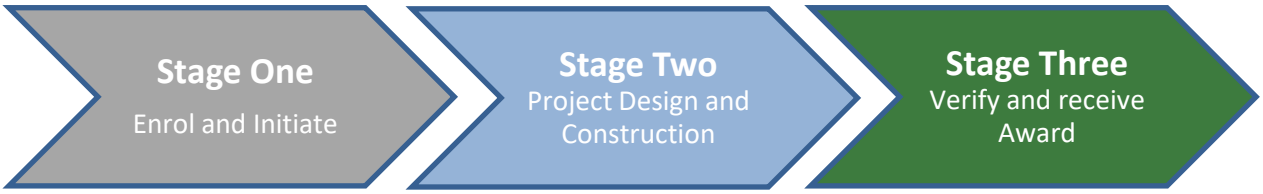


Figure A. Steps in the GSH rating process. *Credit: Stewardship Centre for BC.*

Stage One: Enrolment

Applicants on the Pacific coast can enrol on-line at https://stewardshipcentrebc.ca/Green_shores/ or by contacting SCBC by email, at info@stewardshipcentrebc.ca. In the Maritimes, applicants can enrol on TransCoastal Adaptations (TCA)'s website at https://www.transcoastaladaptations.com/green-shores-for-homes; for assistance in the Maritimes, email TCA at transcoastaladaptations@smu.ca. Once enrolled, applicants will receive a GSH welcome package that describes exactly what is required to meet each Prerequisite and Credit. It is recommended to enrol early in the project design and development process (pre-construction) to maximize the benefits to the homeowner and the environment by using the Green Shores for Homes Credits and Ratings Guide. Early enrolment of a project provides access to essential information and tools such as the GSH Submittal Template that outlines the requirements for submittals for the finalized project. Early enrolment also provides access to technical assistance from SCBC in the interpretation of the credits and opportunities to maximize credits and points. Homeowners of completed projects that wish to participate post-construction are also welcomed to enrol, however potential difficulties with this approach are noted under Stage Two below.

Stage Two: Project Design and Construction

Once the project is enrolled and GSH welcome package received, the homeowner and project designers will typically proceed with the design and construction of the project, with support from SCBC or TCA as required.

Organize project planning and design around the following steps:

1. Ensure that Green Shores for Homes Prerequisites can be fulfilled; without them, an application for GSH rating will not be considered. Note that many of the prerequisites may already be covered by government-mandated development application submission requirements for the project.
2. The design team should become familiar early on with the requirements of each credit and ensure that as the project progresses, all the documentation required for submittal (using the GSH Submittal Template) is collected. Attempting to complete the submittals post-construction can be difficult and expensive, requiring duplication of effort. This can result in incomplete submittals that delay ratings and could result in a lower rating. Please contact SCBC for a high-level assessment of the eligibility of already constructed projects.

3. Review the credits and determine which ones are applicable to the project. For each applicable credit, try to determine how many points the project could acquire. Where possible, the design can then be adjusted to meet higher point levels. Once adjustments have been made, re-total the points to make sure the minimum point total has been achieved for the desired GSH rating level. SCBC can assist with any questions and suggest opportunities to maximize credits and/or points based on the design.
4. Fill out the submittal forms for the applicable credits. The submittal forms are provided in Microsoft Excel format; when entering points for each credit in its applicable form, the point total is automatically generated on the summary sheet.

Stage Three: Verify and Receive Award

Once the project is complete and all the documentation have been compiled, the homeowner/their contractor can submit the completed GSH Submittal Template to SCBC. The Stewardship Centre will then assign a GSH verifier to review the GSH Submittal Template and documentation, which generally requires a site visit. Upon the completion of the verification process, qualifying projects will receive a Green Shores Rating and Award.

Incentives

In addition to the practical and environmental benefits of the initiatives described in this guide, a number of jurisdictions are currently evaluating the possibility of establishing incentives such as fast-track permitting, to encourage homeowner participation in the Green Shores program. As the program matures and incentive programs become available to homeowners, the Green Shores website (https://stewardshipcentrebc.ca/green-shores-home/) will list any participating jurisdictions.

Introduction

Credits Points Summary

Credit Category		Credit	Maximum Base Points	Bonus Points	Monitoring Bonus
Shoreline Processes	1.1	No Shoreline Protection Structures	**15**		
	1.2	Setback/Impact Avoidance	**9**	**1**	
	1.3	Hard Armour Removal	**15**	**4**	**1**
	1.4	Groin Removal	**5**	**2**	
	1.5	Nature-Based Erosion and Flood Management	**12**	**3**	**1**
	1.6	Managed Retreat	**10**	**2**	
Shoreline Habitats	2.1	Enhanced Critical, Sensitive, or Migratory Bird Habitat Stewardship	**6**	**1**	**1**
	2.2	Riparian and Emergent Vegetation	**9**	**3**	**1**
	2.3	Trees and Snags	**5**		
	2.4	Invasive Plants	**4**		
	2.5	Organic Material	**4**	**1**	**1**
	2.6	Overwater Structures	**7**		
	2.7	Access Design	**3**		
Water Quality	3.1	Site Disturbance	**5**		
	3.2	Reduce and Treat Runoff	**6**	**2**	**1**
	3.3	Environmentally Friendly Building Products	**4**		
	3.4	Creosote Materials Removal	**6**		
	3.5	Herbicides, Pesticides, and Fertilizers	**2**		**1**
	3.6	On-Site Sewage Treatment	**2**	**1**	**1**
Shore Stewardship	4.1	Shoreline Collaboration	**8**		
	4.2	Public Information and Education	**3**		
	4.3	Conservation Easement or Covenant	**6**		
	4.4	Shoreline Stewardship Participation	**2**		

Types of Development

The GSH Rating System applies to both new development and renovations or modifications to existing shoreline structures, buildings, or landscaping on residential waterfront properties (including neighbouring lots who work together and apply as one project). Where applicable, individual credits may make a distinction between:

- *Whole site development* where the proposed project involves the entire waterfront lot, and *riparian or shoreline development* where the proposed project occurs only in the area from either the intertidal zone (in a marine environment) or from the littoral zone (in a freshwater environment) to the upper edge of the riparian zone.
- *Lake* (freshwater) and *marine* (saltwater) shorelines.
- *Greenfield* (never previously developed) and *redevelopment* (previously developed) sites.
- *Urban* and *rural* sites that are distinguished primarily on the basis of lot size.
- *Bedrock* and *sediment-based shorelines.* There are detailed systems for classifying shores according to their physical type; however, for the purpose of the GSH rating system, we make a distinction between *sediment-based* shores and *bedrock* shores.

Figure B. Sediment shore examples. *Credit: H. Rueggeberg (left), N. Faghin (right).*

Sediment-based shores (above) are formed of mud, sand, gravel, cobbles, and/or boulders and include those formed from glacial till. Depending on the size of the sediment and the nature of the shoreline processes, these shorelines are moderately to highly erodible, and are sensitive to any activities that interrupt the transport of longshore sediments and the sediment sources that feed them.

Bedrock shores (below) are comprised of solid rock benches or cliffs. These shorelines tend to be stable and resistant to erosion. Some bedrock shores consist of “soft rocks” such as sandstone, which are common in the Maritimes, and are less resistant to erosion. Assessment of erodibility should be conducted by a qualified professional.


Figure C. Bedrock shore examples. *Credit: Archipelago Marine Research Ltd. (left), P. Law (right).*

Meeting regulations in your area

Many of the GSH credits involve activities that are regulated or require permits. Agencies at local, state/provincial, and federal levels review shoreline projects to ensure that they are safe, protect sensitive habitats and species, maintain water quality, and preserve public lands and interests. The multi-layered regulations for shoreline development can be daunting.

Given the many jurisdictions involved, it is not possible to cover regulatory requirements in detail for all shoreline development situations in the Pacific Northwest and Maritime provinces. The “Further Reading” sections following each category list publications by regulatory agencies that provide information on permit requirements. Local government is often the best source of information for all the shoreline requirements in a specific area. For more information, Green Shores training covers the regulatory conditions in each area.

Many jurisdictions are trying to encourage the kinds of practices reflected in this rating system. They may have requirements that favour Green Shore approaches and are working to make the regulatory process smoother for restoration of natural processes along shorelines. Proposals that feature natural beaches and plantings will tend to be more acceptable than those that emphasize armouring; following the GSH process may make any applicable permitting process easier and faster. Many of the items needed for GSH credits are already part of permit requirements and can also be used in applying for a GSH rating.

Using professionals

Many types of shoreline projects require help from one or more professionals. In general, the greater the degree of wind and wave exposure, the greater the need for some professional design expertise, particularly on softer, sediment shores. Rising Seas and Shifting Sands (2021) is a useful resource to help you determine what sort of shoreline design you might need to help you better communicate that to a professional.

Trained, experienced consultants and contractors can help with design, permitting, building, operating, and maintaining a cost effective, sustainable, attractive, and environmentally friendly project.

Depending on the specifics of the project and site, and the professional licensing requirements in your area, consultation may be required with a coastal/shoreline engineer or geoscientist, biologist, geotechnical expert, civil engineer, landscape architect, site designer, machine operator, or permit specialist. Some companies do all these things while others specialize in one or two professions. Of note, the Stewardship Centre maintains a registry of Green Shores Approved Professionals who are skilled at applying Green Shores criteria to nature-based shoreline projects. The registry can be found here: https://stewardshipcentrebc.ca/green-shores-home/gs-resources/gs-approved-professionals/.

Helpful tips for working with professionals:

- Start by identifying priorities: is it erosion protection, landscape design, access, or drainage improvement that is the driver?
- Research possible candidates/organizations on the Internet and by talking to friends and neighbours who have undertaken similar works.
- When talking to possible candidates, stress your interest in 'soft engineering' or nature-based approaches, and ask to see photos or visit project sites. Enquire specifically about the practices that each contractor uses to minimize pollutants, erosion, and impacts on the shore, and their familiarity with the GSH rating system.
- Select three or four candidates, invite them to your property for specific recommendations and acquire estimates. In talking with these professionals, make sure they are confident in their abilities and approach, and are collaborative in their approach to problem solving.

Marine Shoreline Design Guidelines

The *Marine Shoreline Design Guidelines* (MSDG)[3] were published in 2014 by Washington State's resource management agencies to provide a comprehensive framework to help assess the need for shore protection and identify the techniques that best suit the conditions at a given site in the Puget Sound region. These guidelines provide a valuable resource to users of the GSH credit and rating system in helping to assess the need for alternative approaches to shore protection and understand how best to put those approaches into practice.

Reference is made throughout this guide to specific chapters or sections of the MSDG where they relate to the credits. As a general reference, Chapter 5 of the MSDG provides guidance on how to evaluate and, if needed, select an appropriate erosion control technique for a specific site. One of the tools in Chapter 5 is a "decision tree" for identifying appropriate shore protection techniques for a given site; that decision tree is reproduced in Appendix E of this guide.

In 2021, US Army Corps of Engineers (USACE) launched their International Guidelines on Natural and Nature-Based Features for Flood Risk Management.[4] While the USACE guidelines are focused on reducing flood risk, many of the practices and principles align with those in MSDG and the GSH guidelines.

[3] Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines.* Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. http://wdfw.wa.gov/publications/01583/.

[4] US Army Corps of Engineers (USACE), *International Guidelines on Natural and Nature-Based Features for Flood Risk Management,* https://erdc-library.erdc.dren.mil/jspui/handle/11681/41946.

How the Green Shores for Homes Credits and Ratings Guide is Organized

This document provides guidance through the process of applying for Green Shores for Homes credits by using a credits and ratings system similar to LEED® or Built Green®. A GSH rating is obtained by meeting all prerequisite criteria plus a specific number of optional credits.

The next section, "Prerequisites," guides the collection of baseline information prior to preparing a credit submission:

- Prepare an **existing conditions plan** that describes the site conditions.
- Develop a **site design plan** describing the proposed development.
- Prepare an **environmental management plan** outlining your strategies for controlling erosion, sediment, or pollution at the site.
- Identify and prepare to protect any **critical or sensitive habitats** at the site.

The following sections of the guide outline each of the four main credit categories:

- Category 1: **Shoreline Processes**
- Category 2: **Shoreline Habitats**
- Category 3: **Water Quality**
- Category 4: **Shore Stewardship**

Each category section lists the available credits within that category, along with the benefits, points available, and specific requirements for each credit.

Lastly, this guide includes a glossary of terms that may be encountered within this program, and appendices that offer checklists, landscaping guidance, lists of useful plants for shoreline projects, and more.

For more information, visit https://stewardshipcentrebc.ca/green-shores-home/gs-programs/green-shores-for-homes/.

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Prerequisites

To be considered for inclusion in the Green Shores for Homes program, four basic components are required:

1. An **existing conditions plan** describing site conditions;
2. A **site design plan** describing the proposed development;
3. An **environmental management plan** outlining strategies for controlling erosion, sediment, or pollution at the site; and
4. An assessment of any **critical or sensitive habitats**.

Each of these requirements is described on the following pages.

In this Section:

Existing Conditions Plan

In preparation for the GSH program, identify and map out any existing site conditions that will affect—or be affected by—the proposed project.

An Existing Conditions plan is a drawing done "to scale" that shows basic features such as location of the site, property boundaries, terrain elevations and contours, trees and vegetation, as well as buildings and structures in the site and along the shoreline and in the riparian area.[5] In the case of shoreline projects, it should show the water level reference used by the local authority to define setbacks, permits and environmental regulations. Depending on the location this could be the Higher High Water Large Tide (HHWLT), a specific storm surge elevation, the Ordinary High Water Mark (OHWM), or the Natural Boundary (NB).

An Existing Conditions Plan (i.e., Site Survey) is a common component of any set of design drawings typically required by local authorities to approve a building or development project. Therefore, it can often be repackaged to meet this Prerequisite. A checklist is provided in Appendix A for items that must be included in the Existing Conditions Plan in order to meet this prerequisite.

Benefits

To the homeowner

Mapping site characteristics and features is an important tool to inform the design process. A thorough study of site conditions allows homeowners to gain an understanding of key site features and their individual and collective benefits, while helping to identify cost-saving opportunities and constraints. Knowing existing site conditions allows project designers to respond to site conditions in ways that benefit the environment, and in ways that can save money in the long run by helping to prevent costly mistakes and adjustments.

To the environment

Identifying and assessing site features, processes and characteristics *before* developing a detailed design allows features that play vital roles in how the site and shoreline function to be protected early on. For example, areas of valuable vegetation or erodible soils will be identified, and proper buffer zones established before new infrastructure and buildings are placed, minimizing the risk of impacts to nearby aquatic environments.

How to proceed

1. If an existing conditions plan is not available, generate a plan drawing or a map of the existing site conditions.
2. Use the checklist provided in Appendix A to ensure that the site features necessary for inclusion on the existing conditions plan for a GSH application are met. Pay particular attention to features that need to be preserved or protected during construction, such as areas of permeable soils, feature vegetation, existing woodlands, streams, wetlands, riparian areas, significant habitat areas, species at risk, and water storage areas. The range of site characteristics to cover will depend on the project being planned.

[5] See Glossary for definitions of OHWM, HHWLT, NB and riparian area.

3. Take 'before project' photos of the site, noting the position from which the photos are taken on the Existing Conditions Plan, so that you can replicate that same perspective in 'after project' photos.

Following are two examples of Existing Conditions Plans: the first is a typical site survey plan for a single property; the second uses an air photo, likely downloaded from a web-based map site, to show existing conditions for a multi-property shoreline protection project. Either approach is acceptable provided the basic elements in the Submittal Checklist are covered.

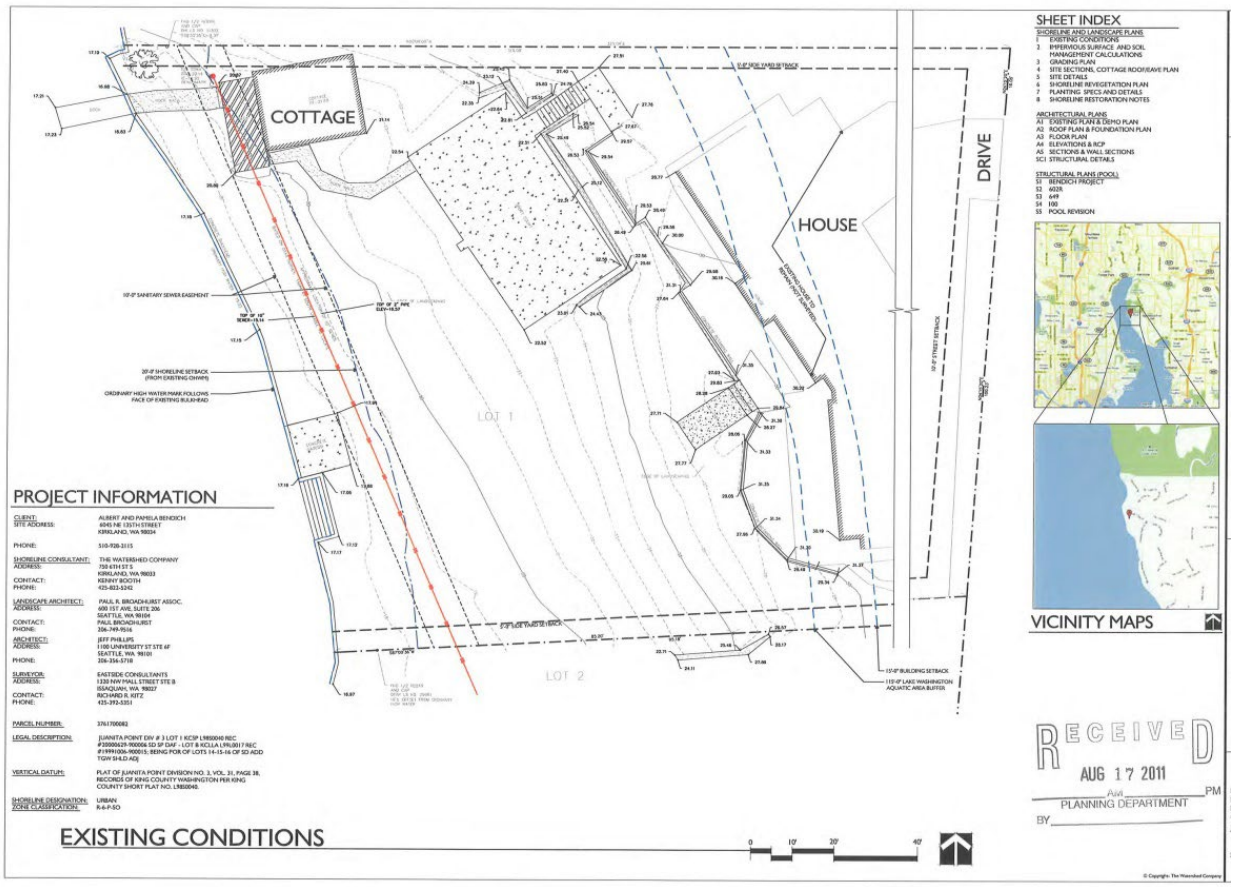


Figure D. Example of an Existing Conditions Plan for a single property. *Credit: The Watershed Company.*

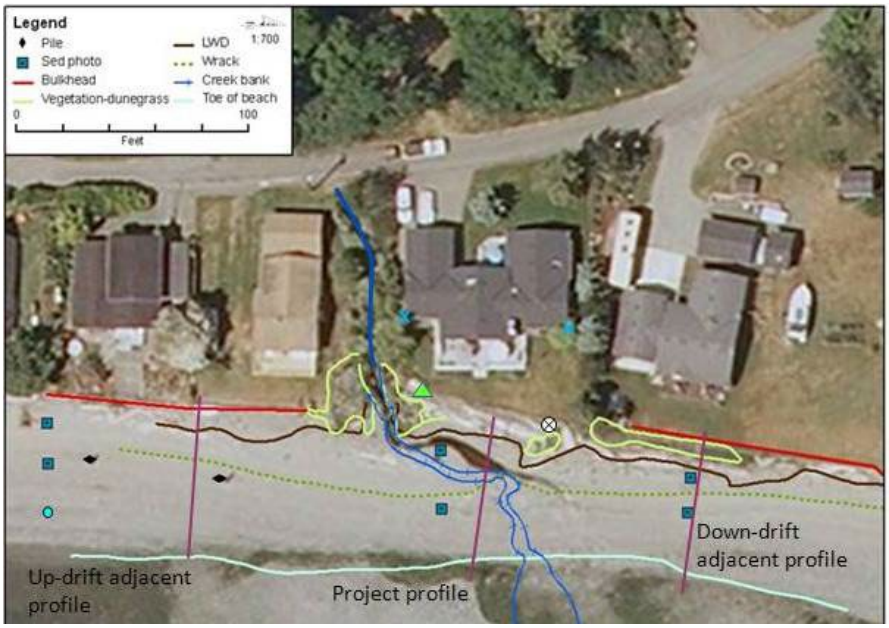


Figure E. Example of an Existing Conditions Plan using an air photo base. *Credit: Coastal Geologic Services Inc.*

Submittals

1. Existing Conditions Plan according to requirements in Appendix A.
2. Completed checklist in Appendix A.

Site Design Plan

Develop a Site Design Plan that shows the proposed development project in the context of current site conditions and processes.

A Site Design Plan is a to-scale drawing or set of drawings that shows the elements of a proposed development project. It usually contains a plan view (view from above looking down, like a floor plan) and may also contain drawings that show side and section views. Like an Existing Conditions plan, a Site Design Plan is a component of project design drawings typically required by local authorities to approve a building or development project. Therefore, to meet this GSH prerequisite, project design drawings can be adapted or reused to meet the GSH Site Design plan submittal requirement.

Benefits

To the homeowner

Developing a Site Design Plan is part of the planning and design process to properly size and locate all the project elements on the existing site. The planning and design process allows homeowners to fit their project to their existing site and to avoid costly alterations to existing site conditions. Completing a simple design plan early in the design process will help identify potential problems and design short comings before they become a real problem. Rather than react to a problem, homeowners can design more efficient homes, multifunctional landscapes and greener shorelines.

To the environment

A Site Design Plan will ensure that all proposed design initiatives are properly sized and located in way that protects important site features and preserves existing site processes and functions.

How to proceed

A Site Design Plan usually starts with the Existing Conditions Plan and then incorporates proposed development and site changes, including:

- Building areas and locations
- Patios
- Driveways
- Pedestrian circulation paths
- Access points
- Overwater structures
- Shore protection structures
- Soil amendment and vegetation planting
- Elevations and slopes of each of the features above

Appendix B provides a checklist for items that must be included in a Site Design Plan. The goal is to fit the desired design elements into the site while maintaining critical existing site features and processes identified in the Existing Conditions Plan (Prerequisite 1).

If protecting an existing structure from erosion is part of your project, Chapters 5 and 6 of the *Marine Shoreline Design Guidelines* (Johannessen et al*.,* 2014 – see full reference under 'For More Information') may provide insights into alternative strategies and methods for weighing design options. While

developed for marine shorelines on the West Coast, there are also useful ideas for lake shorelines and marine shorelines on the East Coast. The following examples depict a typical site design plan.

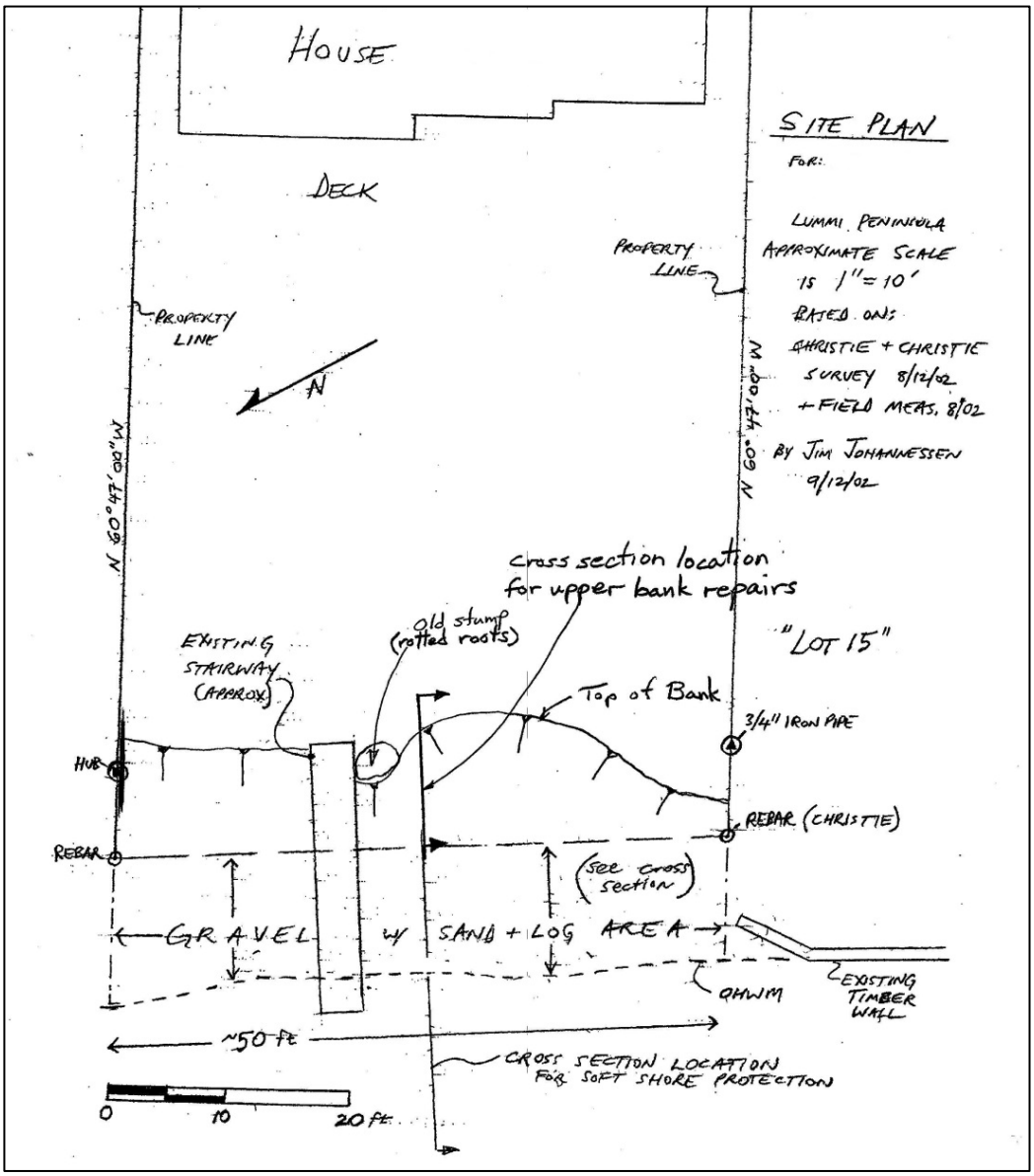


Figure F. Example Site Design Plan (see next page for cross-sections). *Credit: Design by Coastal Geologic Services; from Marine Shoreline Design Guidelines (2014).*

Prerequisites

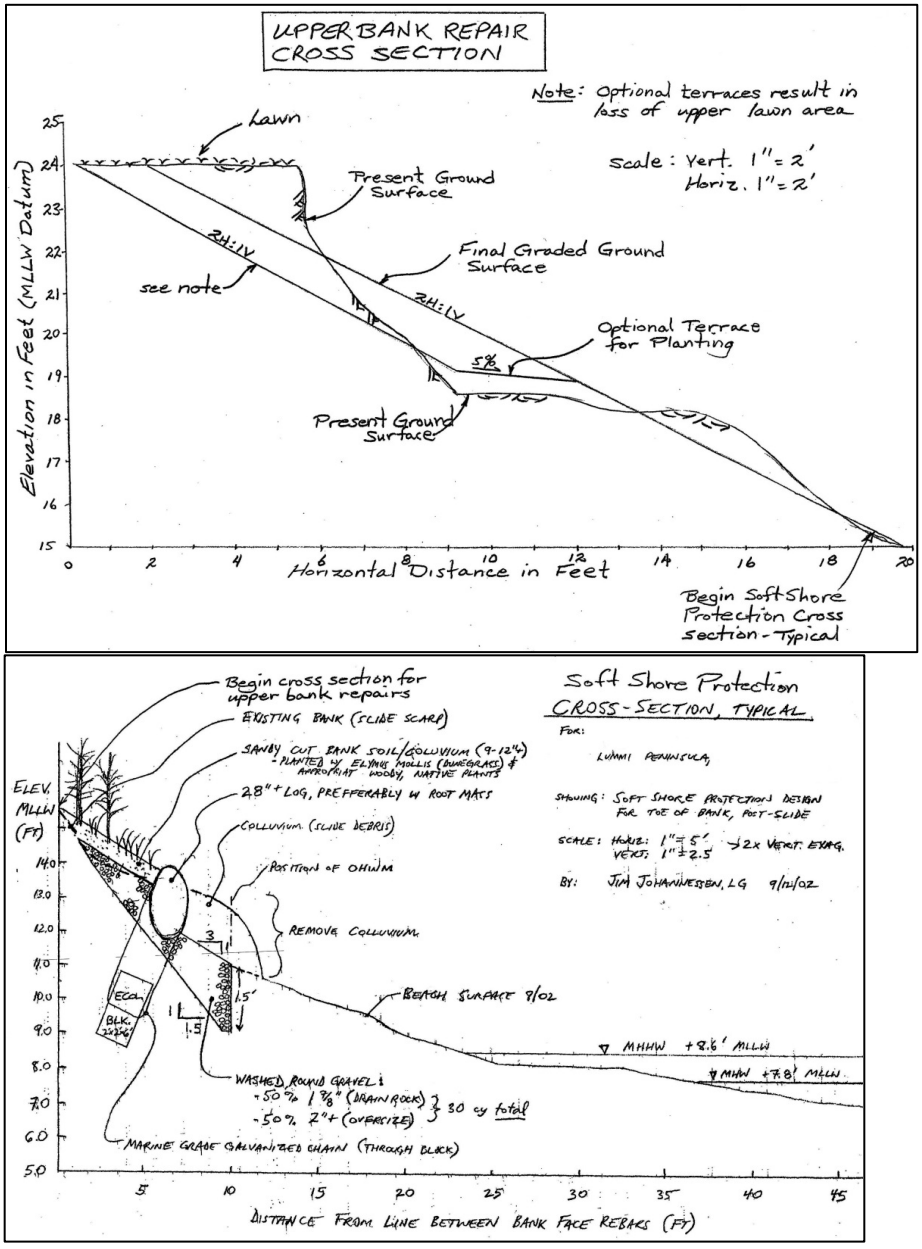


Figure G. Example Site Design Plan—cross-sections to provide detail. *Credit: Design by Coastal Geologic Services; from Marine Shoreline Design Guidelines (2014).*

Submittals

1. Completed Site Design Plan (See Appendix B) including:
    a. Plan view
    b. Cross section view(s)
    c. Riparian plan view
    d. Site access drawing sheet
    e. Excavation drawing sheet (if applicable)
    f. Critical or sensitive habitats plan view (if applicable)
2. Completed Proposed Project Drawing Package Checklist in Appendix B.

Environmental Management Plan for Construction

Develop and implement a plan to limit disturbance, adhere to seasonal construction windows, and address erosion, sediment, and pollutant control on site during construction.

Sedimentation of receiving waters is highest when erodible materials are exposed, particularly during construction. In addition, materials such as paint, drywall compound, concrete wash, and glues need to be managed to prevent pollution. All proposed activities need an Environmental Management Plan for Construction to show how sediment/runoff and pollutants are managed during the construction phase of the project. The plan also considers appropriate timing for construction based on sensitive biological windows for species that may be present in the construction area. Seasonal construction windows identify the times of the year when species (e.g., migratory and breeding bird seasons, larval windows for fish) and their habitats are particularly sensitive to disturbance (e.g., avoid construction during rainy seasons). When construction cannot be timed to fit sensitive biological windows, resources are provided in the plan to minimize and mitigate potential impacts.

This type of plan is often required by local jurisdictions as a "stormwater management plan" or an "erosion and sediment control plan." You can use these plans to fulfill this GSH requirement. For an example environmental management plan, visit the SCBC or TCA Green Shores webpages in the 'For More Information' section at the end of the prerequisites.

Benefits

To the homeowner

Limiting disturbance of existing vegetation and compaction of soils is the best and least expensive form of stormwater management. Managing construction activities and related waste materials before and during construction is simpler and less costly than clean-up and restoration after the fact. A healthy nearshore marine ecosystem and clean freshwater streams contribute to the allure of living on the shoreline. All landowners have a hand in preserving and improving shoreline ecosystems and the overall health of their watersheds.

As the population grows, there will be an increasing number of waterfront landowners who share the shoreline. All waterfront owners want clean water, healthy fish and wildlife, and clean beaches—these not only improve quality of life but also increase property values for landowners.

To the environment

The main benefit is the prevention of runoff of construction-related sediment and pollutants into local ground and surface water. Numerous studies have shown vegetation removal and run-off from upland development to be a primary cause of degraded marine and nearshore water quality. Upland development can increase land-based erosion and land slumping, resulting in sedimentation and smothering of nearshore flora and fauna. Limiting disturbance combined with containing and treating sediment or pollutant-laden water, and containing, reusing, or recycling construction chemicals and materials will help to reverse this trend. Species that are sensitive to disturbance (e.g., migratory and breeding birds, fish) will benefit from lesser or minimal impacts to their habitat.

Prerequisites

How to proceed

The *Environmental Management Plan for Construction* lays out the proposed best management practices (BMPs) to limit disturbance, address erosion and sedimentation, and to prevent, reduce or eliminate water pollution from construction activity. These BMPs include:

- Clear only land necessary to successfully complete the project.
- Minimize areas of vegetation removal and earth movement.
- Conduct construction activities in dry seasons or during appropriate construction timing windows for sensitive species.
- Reduce the amount of heavy machinery required on site.
- Limit where heavy machinery is used on site.
- Know the sources of sediment and pollutants from construction activities and plan for their containment/management in areas where they will have the least impact.
- Develop a strategy for preventing and dealing with spills and leaks.
- If access to the shoreline is needed for construction, identify where and how that will occur to avoid sensitive habitats and timing.
- Look for a conscientious contractor who will economize the use of construction materials; limit the necessary transport of materials to and from the site; minimize disturbance areas and heavy equipment on site; and commit to containing, recycling, reusing, or properly disposing of construction waste.
- Set up waste collection and recycling facilities on site and maintain them throughout and beyond the construction project as necessary.
- If neighbours are also planning projects on their property, consider coordinating environmental management measures. For example, set up a common sediment collector, or share the waste pickup service. It could save both money and resources.

The Submittal Checklist for this requirement indicates the items to include in your GSH application to reflect these best management practices.

Submittals

1. Completed Environmental Management Plan for construction.

Critical and Sensitive Habitats

Avoid impacting critical and sensitive habitats to ensure the conservation and protection of species at risk and facilitate compliance with provincial/state and federal laws that identify and designate critical or sensitive habitats.

Species at risk are species that are at risk of extinction or disappearing, and the level of this risk can vary. Species at risk are generally assessed at federal and provincial/state levels as: extinct, extirpated, endangered, threatened, or special concern. Species at risk and the habitats where they are found can receive protection from federal and provincial/state laws. The *Species at Risk Act* (SARA) (*Species at Risk Act* (S.C. 2002, c. 29)) is the key piece of Canadian federal legislation that protects species at risk and their habitat on federal lands. The purpose of SARA is to prevent wildlife species from becoming extinct and identify the necessary actions for their recovery. As conservation is a shared responsibility, provinces and territories in Canada also have responsibilities to protect and recover species at risk in their jurisdictions. In the United States, the *Endangered Species Act* (ESA) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. In both countries, protection of habitat can also be designated at the provincial/state level and many provinces and territories do this through complementary legislations and programs for species at risk. Terminology to describe habitats important to species at risk, such as critical habitat, can vary based on the local jurisdiction.

Critical Habitat

In Canada, SARA describes critical habitat as the habitat that is necessary for the survival or recovery of a particular species at risk, and this habitat can be legally protected on federal land. In order to meet this prerequisite, your project will need to ensure that activities carried out on your land do not impact critical habitat. The SARA public registry can be found here: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

There are also habitats with designated protection at the provincial/state level. How these habitats are defined and the terminology used to describe them can differ based on location (e.g., province/state). Some of the terminology used to describe protected and sensitive habitats in different provinces/states is outlined below.

In Canada, and particularly in the Maritime provinces and British Columbia, protected habitat can include:

- Critical habitat as identified under SARA: “habitat necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or action plan for the species.”

- In Nova Scotia, Core Habitat is identified under the Nova Scotia *Endangered Species Act* (http://www.speciesatrisk.ca/).

Prerequisites

- In New Brunswick, habitat is described in the recovery strategy for species at risk under the New Brunswick *Species at Risk Act* (https://www2.gnb.ca/content/gnb/en/departments/erd/forestry-conservation/content/species-at-risk.html), and can be delineated into two types:
  - Survival habitat: habitat that is regularly occupied by the species at risk, and
  - Recovery habitat: habitat that is crucial to the recovery of the species at risk but isn't always occupied by any individual of the species.

- In Prince Edward Island, there is currently no legislation specific to species at risk, but some protection for some species could be afforded through their *Wildlife Conservation Act* (https://www.princeedwardisland.ca/en/legislation/wildlife-conservation-act).

- In British Columbia, habitat is defined as areas providing important feeding, resting, spawning, nesting, or rearing habitat for species designated under the BC *Wildlife Act*, or identified as "red" or "blue" listed species by the BC Conservation Data Centre.

In Washington State, this includes:

- Critical habitats identified under the United States *Endangered Species Act* (ESA).
- Priority species habitat identified by the Washington Department of Fish and Wildlife (WDFW) in the *Growth Management Act*.
- Critical areas and critical salt water and freshwater habitat defined by the Shoreline Master Program (SMP) Guidelines (WAC 173-26).
- Under the SMP, critical saltwater habitats include kelp beds; eelgrass beds; spawning and holding areas for forage fish such as herring, smelt and sand lance; subsistence, commercial and recreational shellfish beds; mudflats; intertidal habitats with vascular plants; and areas with which priority species have a primary association.
- Also, from the SMP, critical freshwater habitats include those portions of streams, rivers, wetlands, and lakes, their associated channel migration zones, and flood plains designated as such.

Sensitive Habitat

Sensitive habitats can include federally, provincially, or regionally designated Environmentally Sensitive/Significant Areas, Protected Natural Areas, National Parks, and Nature Reserves. Internationally designated areas such as Ramsar Sites, Important Bird Areas, or Western Hemisphere Shorebird Reserve Network sites also contain sensitive habitat. Sensitive habitats also include valued foreshore habitats, commercial/recreational/First Nation clam beds, tidal channels, important spawning and rearing areas for fish, seabirds, and marine mammals.

For both critical and sensitive habitats, appropriate setback distances must be identified by a qualified environmental professional and shown in the Existing Conditions Plan, and the Environmental Management Plan must outline how impacts to sensitive habitats will be avoided.

Benefits

To the homeowner

Minimizing disturbance to sensitive habitats preserves the attractiveness and vitality of life on the shoreline. These habitats perform many ecological functions that maintain the quality of environment—like controlling erosion and maintaining water quality—far more inexpensively than engineered methods.

To the environment

Preserving critical and sensitive habitats helps to support the biodiversity of native plant and animal populations. This helps species at risk by ensuring critical habitat is available for the species to use when needed.

How to proceed

Before planning and executing a project, determine if any critical or sensitive habitats may be present.

- Identifying species at risk, their habitat and other sensitive habitat is a complex task and should be conducted by specialists. Local conservation groups and biologists/ecologists should be knowledgeable of local species and habitats, familiar with pertinent legislation, inventories, and data sources and may be able to help. As well, check with your local government or at the local offices of environmental NGOs.
- In BC, several regional districts and municipalities have identified and mapped Environmentally Sensitive/Significant Areas and may have additional information on critical species and their habitats. You can also search by municipality for local species at risk on the BC Species and Ecosystems Explorer (see For More Information). Provincial recovery teams can be contacted if a species at risk occurs on your property.
- For many provinces in Canada, information on the location and distribution of species at risk is available online. (https://search.open.canada.ca/openmap/47caa405-be2b-4e9e-8f53-c478ade2ca74). Apps such as NatureCounts or eBird can help you determine if species at risk have been detected on or near your property, even if there is no critical or sensitive habitat identified.
- In Washington State, resources include inventories and maps prepared under the *Growth Management Act*, critical areas, as well as Shoreline Master Program shoreline characterization maps and reports. Watershed and salmon recovery organizations may also have documents that help to identify these resources.

Incorporate these findings into the project plan to help facilitate compliance with legal and regulatory requirements and to help recover species at risk and conserve sensitive habitats.

Prerequisites

- If you have species at risk, critical or sensitive habitats on your property, your current land use practices may already be compatible with species' needs, and these areas should remain untouched.
- For example, if critical habitat has been identified on your property, project activities must not impact these areas (directly or indirectly), and the project design must take this area into consideration.

There are a number of resources that may be able to assist you in finding out whether species at risk and their habitat might be present on the land you manage. Some resources that may be helpful are outlined in the For More Information section, but particularly refer to the recovery documents for each species at risk, as they have the most detailed and up-to-date information available.

Submittals

1. Habitat Assessment Report identifying critical and sensitive habitats prepared by a Qualified Environmental Professional or regulatory agency indicating:
    a. No critical or sensitive habitats present OR
    b. Location of critical or sensitive habitat.
    c. Description of measures taken to avoid impact on critical or sensitive habitat.
2. Completed checklist in Appendix C.
3. Site Design Plan showing critical or sensitive habitats (if applicable) indicating how impacts to these areas will be avoided.

For More Information

General/International

iNaturalist. (n.d.). https://inaturalist.ca/ [citizen science platform for species identification and mapping]

NatureServe (2022). *NatureServe Explorer*. https://explorer.natureserve.org/ [online guide to rare and endangered species and ecosystems]

Ramsar. (2022). https://www.ramsar.org/ [Convention on Wetlands and designated Wetlands of International Importance]

Nature Counts. (2023). https://naturecounts.ca/nc/default/main.jsp

eBird. (2023). https://ebird.org/home

Canada

Fisheries and Oceans Canada. (2022). *Critical Habitat of Species at Risk*. [Aquatic Species data] https://open.canada.ca/data/en/dataset/db177a8c-5d7d-49eb-8290-31e6a45d786c

Government of Canada. (2016). *About the Species at Risk Act (SARA).* https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/about-species-at-risk-act.html

Government of Canada. (2022). *Canadian Protected and Conserved Areas Database.* https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html

IBA Canada. (n.d.). *Important Bird and Biodiversity Areas in Canada.* https://www.ibacanada.com/

Wild Species. (2015). *The General Status of Species in Canada*. https://www.wildspecies.ca/

Critical Habitat for Species at Risk National Dataset [web map]. https://search.open.canada.ca/openmap/47caa405-be2b-4e9e-8f53-c478ade2ca74

Washington State

City of Seattle. (2011). *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington.* https://www.seattle.gov/documents/Departments/SDCI/Vault/ShorelineMasterProgram/GreenShorelines.pdf

Washington Department of Fish and Wildlife. (2022). *Priority Habitats and Species (PHS).* https://wdfw.wa.gov/species-habitats/at-risk/phs

Visit the Green Shores websites for more region-specific resources.

Stewardship Centre for BC: https://stewardshipcentrebc.ca/programs/

TransCoastal Adaptations: Centre for Nature-Based Solutions: https://www.transcoastaladaptations.com/green-shores

Category 1: Shoreline Processes

Shoreline processes refer to the interaction of water, wind, and waves with the shore that shape our diverse beach, bluff, cliff, and estuarine areas.

The shoreline processes credits are intended to encourage waterfront property owners to protect, restore, and/or maintain the natural physical processes that form shorelines and that benefit shoreline ecosystems and the many organisms that live within them.

The credits described in this section are available for restoration and enhancement actions, and for avoiding activities that damage shoreline processes.

In this section:

Credit 1.1: No Shoreline Protection Structures

To qualify for this credit, there should be no existing bulkheads, groins or other shore protection structures on the waterfront property, and none proposed for the foreseeable future.

Figure 1.1.1. A Green Shores design on Vancouver Island, BC. *Credit: B. Emmett.*

Where this credit applies

This credit may apply to any residential shoreline property where no shoreline protection structure is present, required or anticipated. A distinction is made in the Points Available section between rocky shores and sediment-based shores because rocky shores are more resistant to erosion and typically do not need protective structures. Because it is easier to have no shoreline structures on rocky shores than on sediment-based shores, fewer points are available for properties with rocky shores. If the shore is partially bedrock and partially sediment-based, determine the points based on the proportion of each shore type – i.e., (proportion bedrock x 10) + (proportion sediment x 15) = total points.

Example on a 30m/100 ft. shoreline:
18m/60 ft is bedrock – 0.60 x 10 = 6 points
12m/ 40 ft is sediment – 0.40 x 15 = 6 points
Total points applied for = 12 points

Note that this credit cannot be combined with:

Credit 1.3 Hard Armour Removal or Credit 1.4 Groin Removal; you cannot get points for this credit once a bulkhead, groin or other shore protection structure is removed.

OR

Credit 1.5 Nature-Based Erosion and Flood Management; refers to creating a nature-based protective measure whereas this credit refers to leaving a natural shore (soft or hard) alone. While nature-based

Credit 1.1: No Shoreline Protection Structures

protection may not include 'structures' per se, in the hard sense, beach nourishment and wood debris are still human-made protection measures, therefore Credit 1.5 would apply in these situations.

Benefits

To the homeowner

In areas where there is no need for shoreline protection structures (e.g., for erosion), there would be less maintenance and repair costs, fewer obstructions to views, and often better access to the water.

To the environment

No shoreline protection structures mean no impediments to natural shoreline processes and the conservation of shoreline features, functions, and habitats in their natural state.

Points available

This credit offers up to 15 base points

No shoreline protection structures across 100% of the shoreline	Base points
On bedrock shore	**10**
On sediment shore	**15**

How to proceed

Whether structures to protect the shoreline from erosion are needed is an important consideration on many, though not all, waterfront properties. It is possible to forego the construction of a protection structure if the site is not subjected to a high energy wave environment or if allowing erosion suits the homeowner's needs and does not impact the safety of existing infrastructure. Chapter 4 of the *Marine Shoreline Design Guidelines* (Johannessen et al., 2014 – see full reference under "Further Reading") provides help on assessing processes that may be the cause of shoreline erosion. Particularly relevant to this credit, Chapter 6 looks at techniques for managing onsite erosion that do not rely on shoreline structures. While developed for marine shorelines, this document offers useful ideas for lake shorelines as well.

When applying for this credit, show the condition of the shoreline before and after any development project (using site design plans and photos) to illustrate that there are no shoreline protection structures.

Note: Credits 1.3 and 1.4 apply to project sites where existing structures are removed.

Monitoring

- Pre-construction, post-construction and third year monitoring:
    - Provide photographs before and after construction from the same vantage points, showing the absence of the shoreline protection structures.
    - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.

Credit 1.1: No Shoreline Protection Structures

Submittals

1. Existing Site Conditions Plan (Prerequisite 1) showing no shoreline protection structures.
2. Site Design Plan (Prerequisite 2) showing no shoreline protection structures.
3. Photo documentation before and after construction showing no shore protection structures.

If applying for monitoring bonus point:

4. Letter outlining intention to fulfill the monitoring requirements described in Monitoring section above.

Credit 1.2: Setback/Impact Avoidance

To qualify for this credit, ensure that existing or proposed buildings and other major improvements are set far enough back from the shoreline or bluff crest to avoid the need for shore protection structures over the life of the buildings.

Figure 1.2.1. A shoreline with buildings at an appropriate setback distance. *Credit: City of Seattle.*

Where this credit applies

This credit applies to all sites with an existing or proposed home or other major building. 'Major buildings' are permanent houses/dwellings or buildings intended for human habitation. This credit does not apply to 'minor buildings', which are secondary buildings not intended for human habitation (e.g., garage, shed, gazebo, patio, deck, etc.). This credit is particularly important for bluffs that provide sediment to the natural shoreline system, known as feeder bluffs, and sites exposed to high wave-energy. The use of an adequate setback to avoid damage over the life of the building or improvement is an important design consideration. Determining an adequate setback must take sea level rise and climate changes into consideration, which generally will require larger setbacks. Also note that under the continuous changes inherent to climate change and depending on the shoreline type, safe setbacks can vary over time.

Benefits

An adequate setback is the single most effective action to save money, ensure peace of mind, and protect shoreline habitat over the long run.

To the homeowner

A substantial setback distance can result in significant savings over the life of a house, particularly in avoiding the cost of installing hard armour, soft shore protection, or other actions to mitigate erosion and shoreline hazards.

Credit 1.2: Setback/Impact Avoidance

To the environment

A building setback that is sufficient to last for 80 years or more of safe use of a property without requiring the installation of "hard" structures, is among the most effective methods of maintaining natural processes and protecting ecological functions of shorelines. Setbacks address the root causes of habitat degradation, and not just the risk or consequences of having an insufficient distance from an eroding shore.

Points available

This credit offers up to 9 base points plus up to 1 bonus point.

Setback/Impact Avoidance Credit Requirements	Base points
Current regulatory setback: Meet the current setback from the Ordinary High Water Mark (OHWM), Higher High Water Large Tide (HHWLT) or the Natural Boundary (NB) or a similar reference line required in your local jurisdiction, with no variance or relaxation of that requirement. This setback may be specified in a zoning regulation, shoreline development or habitat protection regulation, or be determined on a site-basis by local regulators.	**3**
Add SLR: For a marine shoreline, along with the regulatory setback, show that the setback also reflects changes in the level or location of the OHWM/NB/HHWLT based on the predicted sea level rise (SLR) used by the local jurisdiction. Use a 1m/3ft SLR if there are no specific predictions for your area.	**4**
OR, Instead of accounting for SLR:	
80-year setback: Meet the distance from OHWM/NB/HHWLT (or similar reference line in your jurisdiction) needed to allow for natural beach/bluff processes, without armouring or other shoreline protective action, over 80 years or the life of the building, whichever is greater. Calculate this distance based on an erosion rate estimate for the site provided by a qualified source such as a Qualified Coastal Professional. **Alternative:** If there are no data available to estimate an erosion rate, provide an 80-year setback required by the local jurisdiction or **minimum 25m/75 feet, whichever is greater.**	**6**
Bonus (available only if one of the base conditions above is met)	**Bonus points**
Bluff site: Apply the SLR or 80-year setbacks above on a **feeder bluff** site (see Guide sec. 2.2 or Glossary for definition of a feeder bluff). This bonus point is to encourage the maintenance of a feeder bluff sediment input and to maintain the habitats of a bluff-beach system.	**1**

Credit 1.2: Setback/Impact Avoidance

How to proceed

Current regulatory setback:

In the context of this guideline, a setback is the distance from the shoreline at which a building is constructed. Many coastal jurisdictions have regulations defining the minimum setback from the OHWM/NB/HHWLT, or a similar baseline. Some regulations may exceed the setbacks determined according to the methods described in this section. In all cases, to meet this credit, the setback in your project must equal or exceed the setback required by regulation in your jurisdiction.

If you can demonstrate that the existing regulatory setback meets or exceeds the SLR predictions or 80-year setback, then you are eligible for the points awarded for these setbacks.

SLR

To assess the impact of sea level rise, the following steps are recommended:

1. Identify the predicted sea level rise (SLR) for your area.
    - For example, SLR levels of 0.5 m/1.5ft to the year 2050, 1.0 m/3ft to 2100 and 2.0 m/6ft to 2200 are predicted for most of the BC coast. The Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT) provides estimates of SLR allowances at wharves throughout Canada. In the US, sea level predictions can be found through the National Oceanic and Atmospheric Administration (NOAA).

2. Determine how this will change the location of the base reference line on your property over the next 80 years or throughout the life of the project, whichever is greater.
    - This may require the assistance of a land surveyor to show this new location on the ground and on a site map. Apply the Regulatory Setback measured from this future OHWM/NB/HHWLT.

80-year setback

The first step is to estimate the erosion rate or range of likely erosion rates for your site. Erosion rates may be available for some areas through:

- Geological/Geotechnical reports.
- USGS/Environment Canada published maps.
- Beach Watchers and other credible citizen science organizations.
- Provincial resources such as the New Brunswick Coastal Erosion Database, the Coastal Hazard Assessment for PEI, and for all Maritime provinces, ClimAtlantic.

However, these sources are quite limited spatially, and erosion rates can vary significantly over short distances, so applying a rate from a different location must be done with caution. Also, erosion rates cannot be determined with only short-term data. The problems caused by higher water levels and more intense storms are not limited to ocean front properties. Increased shoreline erosion due to climate change is a challenge to both sea and fresh waterfront properties.

Green Shores approaches and climate change
Climate change presents challenges to waterfront properties, particularly those on marine shores. These challenges include:

- Sea level rise, higher wave heights and more intense storm surges— all resulting in more coastal flooding.
- Increased rainfall in winter months and with it, increased surface runoff. This may be compounded by drainage problems caused by higher sea levels that cause drainage ways to back up.
- All of the above, causing increased shoreline erosion.

Green Shores approaches can help address some of these challenges by reducing runoff and creating more resilient shorelines.

A qualified professional geoscientist or coastal engineer can help you determine a site-specific erosion rate, using aerial photos. Estimate the erosion rate from the best available air photos at 1:12,000 scale or better over the longest time period possible. Ideally, this would be 50 years or more, but due to limited air photo and survey records, 30-40 years is more realistic. Alternatively, small scale (less than 1:10,000) topographic or other survey maps of the site over similar time periods can be used. These maps should show bluff crest or similar identifiable shoreline features and include documented methods so that others can assess the level of accuracy.

Once the erosion rate is estimated, the setback for the life of a building (minimum 80 years) can be calculated. For example:

If estimated average erosion rate = 10cm/4in per year

Then 80-yr setback = 8m/320in or ~27ft from OHWM.

Alternative
In the absence of any data to support an estimate of erosion rates as described above, use a minimum setback of 25m/80ft from the projected reference line (OHWM, natural boundary, or similar) or that required by your local regulators (whichever is larger).

Bluff site (bonus point)
Identify the presence of a feeder bluff on your site or next to it. As noted above, this bonus point is to help maintain sediment input to shorelines by feeder bluffs and with it, the habitats of a bluff-beach system, particularly forage fish and other habitats reliant on sediments. Feeder bluff mapping may be available in your local area.

Monitoring

- Pre-construction, post-construction and third year monitoring:
    - Provide photographs before and after construction from the same vantage points, showing buildings setback.
    - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.

Credit 1.2: Setback/Impact Avoidance

Submittals

1. Current regulatory setback for local jurisdiction.
2. Site Design Plan (Prerequisite 2) showing: location of OHWM or NB, location of setback boundary (regulatory, SLR or 80-year) and location of major buildings.

If applying for SLR points:

3. SLR predictions for local area and predicted change in location of OHWM/NB.

If applying for 80-year setback points:

4. Erosion rate estimate and setback calculations OR 80-year setback requirements.

Credit 1.3: Hard Armour Removal

To qualify for this credit, reduce or remove any type of hard shore armour (including bulkheads, riprap or armourstone).

Bulkheads are vertical or almost vertical structures installed along the shore to either mitigate the erosive effects of large waves or serve as retaining walls. Bulkheads have been constructed on all types of shorelines but are most common along erodible beaches and non-bedrock bluff sites. Other types of hard armour structures include seawalls, revetments, riprap, gabions, and similar along-shore structures. This credit allocates higher scores for complete armour removal, and lower points for partial removal.

Figure 1.3.1. Hard armour examples. *Credit: The Watershed Company, H. Rueggeberg.*

Credit 1.3: Hard Armour Removal

Where this credit applies

This credit applies to any site where hard armour structures exist. Hard armour removal is particularly important at feeder bluff sites where it can restore the natural sediment supply, potentially providing the most benefit to shoreline processes and habitats. Hard armour removal is also important on beaches where forage fish spawn, because it can help to restore critical habitat in the nearshore and foreshore food web.

Hard armour removal may not be feasible on small lots with limited space between a house and the shore and no room to move the house back. A Qualified Coastal Professional (coastal geoscientist or engineer) can advise on the stability of a site and the effect of hard amour removal prior to considering this action. It may be possible to remove part of a hard armour structure or move a hard armour structure like a bulkhead back to restore a partial beach.

When a hard armour structure, such as a bulkhead, is removed, some form of protection from erosion is often still needed. In these situations, the beach profile is modified using nature-based measures, in which natural materials (beach gravel, sand, logs, vegetation, etc.) are added to the shore to mimic natural conditions and maintain natural processes.

The point values under this credit take the replacement of hard armouring with a soft shore into account.

Therefore, this Credit CANNOT be combined, for the same length of shoreline, with:

- Credit 1.1 No Shoreline Protection Measures, i.e., you cannot get points for Credit 1.1 once a bulkhead or other shore protection is removed.
- Credit 1.5 Nature-Based Erosion and Flood Management EXCEPT if a bulkhead or other hard armour structure is removed from one portion of the shoreline (this Credit) and another portion of the shoreline that was previously unprotected is treated with nature-based methods (Credit 1.5).

Figure 1.3.2. Bulkhead removal - before, during and after. *Credit: King County Water and Land Resource Division.*

NOTE that if you have a shoreline that is part bulkhead removal and part soft shore protection and are applying for both credits 1.3 and 1.5, you can apply for the bonus points regarding spawning habitat and a monitoring plan under one of these credits only, not both.

Benefits

To the homeowner

Benefits for shoreline owners and users of the beach include reduced maintenance of shoreline structures, improved shoreline access, increased aesthetic value, and improved fish and wildlife viewing.

- Hard armour structures have a finite life cycle and require maintenance or replacement over time. Hard armour structures can fail either incrementally or catastrophically for a number of reasons including undermining of the base, battering by drift logs, loss of integrity due to rot or other deterioration, overtopping and scour during storm surges, or flanking erosion at the ends of structures. Additionally, future sea level rise and climate change may accelerate damage to bulkheads.
- A bulkhead or other hard armour design often creates a barrier for a property owner to the shore; replacing it with a soft shore eliminates that barrier and can make for safer access to the water.
- Sand and pebble beaches are highly valued, but bulkheads often block the replenishment of finer beach sediments, causing a steepening of the beach profile and changing the composition from sand/small gravel to cobble/boulder.
- Although aesthetic values are hard to quantify, the removal of non-natural materials such as concrete and riprap from an otherwise natural beach environment is generally viewed as an improvement.
- Fish and wildlife tend to favour beaches with adjacent vegetated areas, which are almost always increased in quantity and quality following hard armour removal. This leads to increased fish and wildlife use and increased viewing opportunities.
- Over the long run, it is often more cost effective to relocate buildings landward than to build, mitigate, and maintain shore armouring.

To the environment

Removing hard armour is one of most beneficial actions that can be performed on an armoured waterfront property in terms of improving natural processes and nearshore habitat conditions. These high-impact structures have a broad suite of impacts on shorelines:

- Hard armour hinders shoreline processes such as sediment supply and the transport and recruitment of large woody debris (LWD).
- Hard armour structures can indirectly impact down-drift shores by decreasing sediment supply and increasing erosion. The physical presence of a structure can reduce or block the movement of upland and bluff sediment from feeder bluffs, which provide sediment to the beach through erosion and landslides. Blocked sediment supply affects both onsite and down-drift beach profiles and substrate composition— often converting sand and gravel beaches to larger diameter cobble and boulder composition.
- Many nearshore fish and wildlife species require functioning high intertidal habitats to provide sources of food, migration corridors, cover/micro-climate effects, and spawning habitat. Hard armour structures can bury or cause the loss of these important habitats, a process referred to as coastal squeeze. The removal of hard armour allows for the recovery of nearshore habitats previously buried beneath or behind armour.

Credit 1.3: Hard Armour Removal

- Armoured structures may not have been built using the most environmentally friendly materials (creosote treated wood, concrete, etc.). As these materials age and fail either incrementally or catastrophically, they negatively affect water quality and shoreline habitat.
- Armouring impedes the connectivity between terrestrial and aquatic ecosystems. It hinders riparian vegetation from providing insects and leaf litter as food for fish and invertebrates, prevents the recruitment of woody debris to the shore, alters groundwater regimes, and hampers animals transitioning between habitats (i.e., for food, reproduction, water, and shelter).

Points available

This credit offers up to 15 base points plus up to 5 bonus points.

Hard armour removal	**Base points**
Net hard armour removal* along 95-100% of the shoreline	**15**
Net hard armour removal* along 75-94% of the shoreline	**11**
Net hard armour removal* along 50-74% of the shoreline	**8**
Net hard armour removal* along 25-49% of the shoreline	**4**
Net hard armour removal* along 10-24% of the shoreline	**2**
Hard armour moved back	**Base points**
Move hard armour back along 80-100% of the shoreline so that it is minimum 3ft (1m) above the Ordinary High-Water Mark (OHWM)	**8**
Move hard armour back along 40-79% of the shoreline so that it is minimum 3ft (1m) above OHWM	**4**
Bonus (available once one or more base conditions have been met)	**Bonus points**
Area of hard armour removal is in a drift cell and/or at a feeder bluff**	**2**
Hard armour removal is within a shore area with documented spawning habitat for marine or freshwater fish and/or invertebrate species	**2**
Monitoring (3 years post-construction)	**1**

*Net hard armour removal means:

- For a hard armour structure that extends the full length of the shoreline, the length removed minus any length that is retained or replaced with armouring. E.g., if 30m/100ft of seawall is removed and 6m/20ft is replaced with a riprap revetment, the net bulkhead removal is 80%.
- For a hard armour structure that extends along only a portion of the shoreline, the % shoreline along which the hard armour is removed minus the % shoreline where armouring is retained or replaced. E.g., if a seawall extending along 23m/75ft of a 30m/100ft shoreline is removed and none of it is replaced with armouring, the net hard armour removal is 75%. If 5m/15ft of the original wall is replaced with riprap, the net bulkhead removal is 23-5=18m /75-15 = 60ft or 60% of the shoreline.

**In Washington State, to determine if a site is in a drift cell, check mapping at the Washington Dept. of Ecology Coastal Atlas map server: https://fortress.wa.gov/ecy/coastalatlas/. In the Gulf Islands of BC, go to www.islandstrust.bc.ca and search for “Integrated Shoreline and Watershed Maps”.

The following explains the Points Available table above.

- Hard armour removal: Full (100%) hard armour removal is ideal, but may not always be possible; for example, it may be necessary to retain portions of a bulkhead or keep end walls to tie into adjacent bluffs or bulkheads on neighbouring properties. Some shore armour may need to be retained or replaced to protect foundations and underground services. Therefore, points are available for removing a bulkhead from 10% to 100% of the shoreline of a property.
- Moving hard armour back/landward: In some cases, limited lot size may dictate the need for some sort of armouring to protect a home or important infrastructure. In these cases, it may be possible and advantageous to replace a deteriorating structure with a new one, further back from the OHWM. This can allow room for restoring shoreline habitat AND put the armour where it will require much less maintenance or be prone to damage. By moving hard armour back, a homeowner can gain a beach with its many amenities as well as re-establish habitat for shoreline flora and fauna (see Figure 1.3.3).
- Bonus points: It is particularly beneficial to shore habitats to remove or move hard armour structures where they block natural erosion and accretion processes (i.e., in a drift cell or below a feeder bluff), and where they occur next to fish and invertebrate habitat. Monitoring the effect of the bulkhead removal over the following 3 years allows everyone to learn more about the effectiveness of this action on habitat and shoreline processes. It also provides an owner the opportunity to modify or improve the shoreline design before any serious failures occur. The Monitoring section below outlines the requirements to achieve the monitoring bonus point for this credit.

How to proceed

Hard armour removal projects should maximize the restoration of natural processes while balancing the need for property protection. Safe, full hard armour removal and habitat enhancement is the goal of these types of projects. However, a removal or modification design needs to balance the risk of damage to primary structures with the enhancement of shoreline processes and habitat. Analysis, completed by a Qualified Coastal Professional, may still recommend the use of a shore protection measure at the site (hard or soft). Given that this credit aims to incentivize hard armour removal, points are credited for total or partial removal of the structure, and for retreat of the armour along the shoreline to elevations higher than 1m/3ft above the OHWM.

Hard armour removal projects can involve single or multiple properties and can take different approaches, depending on how much of the bulkhead or other structure is removed and what is done to the shoreline afterwards. Hard armour projects may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial, or federal authorities before getting started.

When considering the removal or retreat of hard armour structures along your property shoreline, consider the following:

- Determine the location of your site within the local/regional longshore drift pattern.
- Slope stability of the site. Engage a qualified professional (civil or geotechnical engineer) to determine the geotechnical characteristics of the slope and assess its stability after bulkhead removal and potential risk to existing infrastructure or utilities located at the top of the slope.

Credit 1.3: Hard Armour Removal

- Estimate shoreline change (amount of accreted or eroded shore after hard armour removal) and evaluate the potential evolution of the site after bulkhead removal.
- Identify whether additional shore protection or habitat enhancement elements may be needed (including beach nourishment, vegetated stabilization, or additional structures) or excavation of non-compatible material.
- If site conditions and the location of existing infrastructure prevent the removal of a hard armour structure, evaluate the option of relocating the structure landward at an elevation higher than 1m/3ft above the OWHM.
- Evaluate effect of removal on adjacent shore and adjacent properties.
- Evaluate requirements for hard armour material disposal.

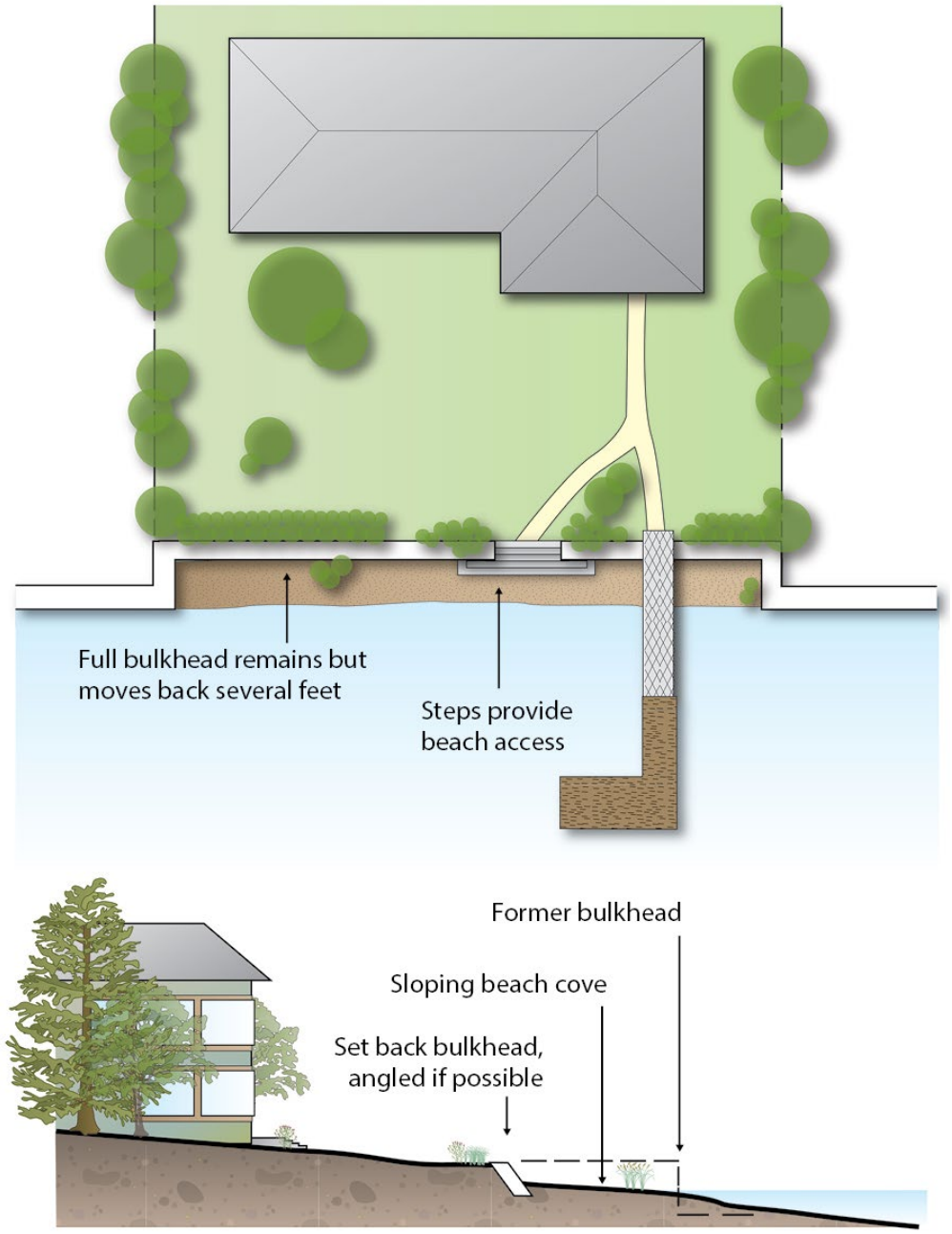


Figure 1.3.3. Moving a bulkhead back schematic. *Credit: City of Seattle (2011).*

Ongoing maintenance

Note that removing a hard armour structure and replacing it with a nature-based method is not a zero-maintenance option. Most soft shore protection measures require maintenance or replenishment in several years, depending on the level of activity of shoreline processes.

The *Marine Shoreline Design Guidelines* (Johannessen et al., 2014) devotes a chapter to bulkhead removal (Chapter 7, Technique 4). It provides guidance on whether it is appropriate to remove a bulkhead given site conditions, and provides insights on effects, cost, monitoring, and maintenance.

Credit 1.3: Hard Armour Removal

While developed for Washington's marine shorelines, there are still useful ideas for lake shorelines and conditions in the Maritimes. Use this guide with the advice of a qualified professional.

Adding a soft shore, or not

Often when a hard armour structure is removed, the beach profile is modified using soft shore protection measures; natural materials (beach gravel, sand, logs, vegetation, etc.) are added to the shore above and below the OHWM to mimic natural conditions. Soft shore materials are added when protection from erosion is still needed after a bulkhead is removed, or when it would assist shore habitat restoration.

In some situations, a bulkhead may be removed and the beach profile left to be restored naturally by waves and currents – i.e., with no added soft shore material. The upland above the bulkhead may still need to be graded to a more gradual slope, particularly where the bulkhead was originally backfilled; otherwise, the fill could slough into the foreshore and intertidal areas, smothering the habitat. Whether or not soft shore protection is needed in a bulkhead removal project should be discussed with a qualified professional (coastal geoscientist or engineer).

Monitoring

- Pre-construction, post-construction and third year monitoring: Provide photographs before and after construction from the same vantage points, showing the absence of the shoreline protection structures (after removal).
    - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.
- For long-term monitoring (3 years after construction):
    - Has the hard armour removal been maintained? If yes, provide photo from the same vantage point.
    - If hard armour has been moved OR new armour was added, indicate that on the site map and provide a photo.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing location, nature, and extent of armouring.
2. Site Design Plan (Prerequisite 2) showing location and length of hard armour removed or moved back, and percentage (%) calculation of hard armour removed or moved back.
3. Photo documentation of bulkhead/armouring before and after construction.

If applying for bonus points:

4. Proof that hard armour removal is within drift cell or at feeder bluff AND/OR
5. Documentation that the hard armour removal is within a shore area that provides spawning habitat for fish or invertebrates AND/OR
6. Letter outlining intention to fulfill the monitoring requirements described in Monitoring section above.

Credit 1.4: Groin Removal

To qualify for this credit, remove groins and any other structures that extend perpendicular to the shoreline (cross-shore) and impede sediment transport or tidal circulation (wherever removal is feasible and would restore physical processes).

These types of structures include groins/groynes, boat ramps, jetties, large stormwater outfall pipes, and other structures which extend from the shore and trap littoral sediment on one side or significantly alter tidal circulation. The goal is for complete structure removal, although lower points are awarded for partial removal.

Where this credit applies

This credit applies to any site where a groin or similar perpendicular structure significantly impedes littoral transport or tidal circulation. Emphasis is on sites within littoral drift cells, although removal of a groin can benefit all types of shorelines.

This credit CAN be combined with:

- Credit 1.3 Hard Armour Removal (if a shore-parallel structure is also removed) or
- Credit 1.5 Nature-Based Erosion and Flood Management or Enhancement (if a soft shore is also constructed).

Where this credit does not apply…

This credit is applicable to groins, or portions thereof, that impede natural sediment transport, which occurs primarily in the foreshore (shallow littoral zone) along lakes and the intertidal zone in marine environments.

In marine systems, subtidal groins may provide reef-type habitat. In most cases, subtidal groins or subtidal portions of groins should not be considered for removal. In lakes, however, groins that extend into the deep littoral zone may force juvenile fish into deeper water where they fall prey to predatory fish species. In these cases, groin removal may be desirable. Check with local expertise on whether to remove deeper portions of a groin.

Figure 1.4.1 Examples of groins. *Credit: H. Rueggeberg (left), M. Henigman (right).*

Groin removal is not feasible in locations where removal would cause significant up-drift or down-drift erosion in developed areas; for example, if a house is already located very close to a beach that is being

held in place by a groin, it may not be feasible to remove the groin as part of renovations on the property. A Qualified Coastal Professional (coastal geoscientist or engineer) can advise on the stability of a shoreline and the effect of groin removal on that stability prior to considering this action.

Several beaches enhanced through beach nourishment have used drift sills, which are low-elevation groins with the up-drift beach filled to the top of the groin with nourishment sediment. These drift sills were used in areas with impeded natural processes or where major buildings, or infrastructure are located very close to moderately energetic shores. Removal of drift sills is typically not advised as the beach nourishment sediment may become unstable.

This Credit CANNOT be combined with:

- Credit 1.1 No Shoreline Protection Structures, i.e., you cannot get points for Credit 1.1 once a groin or other shore perpendicular structure is removed.

Benefits

To the homeowner

Benefits for shoreline owners and beach users include reduced time and cost for maintenance, increased aesthetic value, and possibly improved fish and wildlife viewing. Groins have a finite life expectancy and require maintenance or replacement over time. Groins can fail either incrementally or suddenly for a number of reasons including undermining, battering by drift logs, and loss of integrity due to rot or other deterioration. If a groin is removed, it will no longer require maintenance.

To the environment

The benefits of groin removal include restoring sediment transport processes and alongshore connectivity, as well as the recovery of intertidal and backshore habitats buried beneath the structure.

Groins and similar beach structures often result in a variety of negative impacts to nearshore areas, which are similar to those associated with hard armouring. The magnitude of the impacts varies depending on the individual site and size and configuration of the structure and amount and size of sediment. Larger groins that extend below lower low water levels often result in littoral sediment being shunted offshore and lost from the beach system.

The Impacts associated with groins include:

- Decreased sediment supply to down-drift shores,
- Localized erosion on the down-drift side of structures,
- Burial of habitat areas,
- Disruption of shoreline processes; particularly when sited where interactions with wave and tidal forces are greatest, and
- Altered sediment composition surrounding structures.

Decreased sediment supply can affect on-site and down-drift beach profiles and substrate composition. Groins and other cross-shore structures can cause the burial of important habitats such as marine forage fish spawning areas and lake sockeye spawning areas (Rice, 2006).

Additional adverse impacts depend on the level of impaired along-shore connectivity resulting from the structure, which can include loss or reduction in the transport of sediment and large woody debris

(LWD). Each of these impacts has direct and indirect effects on riparian areas, spawning habitats, eelgrass beds, and shellfish areas (Clancy et al., 2009).

Points available

This credit offers up to 5 base points plus up to 2 bonus points

Groin removal	Base points
Removal of a large groin or other cross-shore structure that spans from the lower intertidal zone (below ½ of the local tidal range) to above the Ordinary High Water Mark (OHWM)	**5**
Removal of a groin or similar structure that spans the upper intertidal zone (above ½ of the local tidal range) to above OHWM	**3**
Bonus (available once the base conditions have been met)	**Bonus points**
Demonstrate that littoral sediment transport has been reduced or blocked by the structure to be removed, as evidenced by a higher beach level on one side of the structure.	**2**

How to proceed

Since it involves working in the foreshore and fish habitat, groin removal may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal authorities before getting started. Also, be aware that removing a groin may affect your neighbour's property—positively or negatively. Seek the advice of a qualified professional before getting started.

Groin removal typically involves pulling out a structure, filling all depressions with appropriate beach sediment, and planting native vegetation if appropriate. It is important to remove all portions of the structure, including materials buried below grade. This prevents armour material or debris from surfacing in the future following adjustments in beach elevation.

Removal of groins of moderate or larger size can change accretion and erosion patterns. Assess shoreline processes at and around your site and how they might be changed as part of design plans (as described earlier in the prerequisites Existing Conditions Plan and Site Design Plan).

Figure 1.4.2. Groin removal on Whidbey Island WA: before and after. Although removal was not complete, erosion on the left or down-drift side is diminished due to reduced littoral drift interruption; note that the shoreline to the left of the groin is less indented or offset after removal. *Credit: J. Johannessen.*

Credit 1.4: Groin Removal

For small removal projects, do a general assessment of the effects on local erosion and deposition on your shoreline and your immediate neighbours' shorelines; for larger removal projects, do a broader assessment of implications for the shoreline in your area—see Clancy et al. (2009) for details. Steps to take for your assessment are:

- Identify the geologic setting of the site, sediment transport processes, general erosion/accretion trends for the project area and the role of the existing groin regarding sediment transport processes.
- Identify areas that are currently being influenced by the existing groin or beach structure.
- Consider the erosion potential associated with adjacent properties.

You may be able to determine whether your structure is in a drift cell using maps published by the Department of Ecology in Washington State, the Islands Trust in BC, or other sources as available (see Further Reading section below). To determine if sediment transport is blocked or impeded, observe the beach level on each side of the structure to see if one side is higher by 0.5m/1.5ft or more. Additionally, confirm the absence or presence of pollutant or toxic construction materials and check with your local environmental authority about permitting requirements for demolition and disposal of groin materials.

Monitoring

- Pre- construction and post-construction:
    - Provide photographs before and after construction from the same vantage points, showing the groin removal.
    - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing low tide level and extent of structure in the intertidal zone (i.e., between OWHM and low tide).
2. Site Design Plan (Prerequisite 2) showing extent of structure removed relative to OHWM and low tide.
3. Photo documentation of the structure before and after removal. Photos taken at low tide.

If applying for bonus points:

4. Documentation (e.g., photos, maps) showing that the structure was in a drift cell and reduced/blocked sediment transport.

Credit 1.5: Nature-Based Erosion and Flood Management

To qualify for this credit, use nature-based approaches for shore protection rather than hard structures where shoreline erosion control is needed.

Nature-based adaptation is an umbrella term that includes a variety of approaches, such as shoreline management approaches that seek to work with natural coastal processes and coastal habitats. Nature-based approaches to shoreline management recognize the dynamic nature of the coast and work with natural coastal processes and ecosystems to balance human needs with those of the natural environment. Shoreline projects are nature-based when they protect and restore coastal processes and habitats, and they often require adjusting land uses and behaviours to ensure the long-term benefits to society of healthy coastal ecosystems, and shorelines that can better adapt to climate change impacts.

Figure 1.5.1. Beach nourishment before and after, west Marchs Point, Skagit Co. WA. *Credit: Coastal Geologic Services.*

There are many types of nature-based approaches for shoreline protection. Some involve maintaining (Credit 1.1) or re-establishing a natural shore while others involve the use of natural materials (gravel, logs, etc.) to create shorelines with attributes that provide functions for people (i.e., erosion protection, wave reduction, recreation) as well as ecosystem functions (i.e., habitat, coastal processes). Nature-based approaches often integrate upland and coastal management. Nature-based approaches include a spectrum from natural shorelines to hybrid solutions but not hard armouring (Figure 1.5.1). This credit covers projects that re-establish natural shoreline features or recreate shorelines that mimic natural habitats and processes while also addressing challenges faced by property owners such as erosion.

Nature-based measures for shore protection: Actions to protect, sustainably manage, and restore shoreline habitats and physical processes for the long-term benefit of people and the environment, providing effective, adaptive, resilient solutions to social and environmental challenges. Adapted from IUCN, 2021.

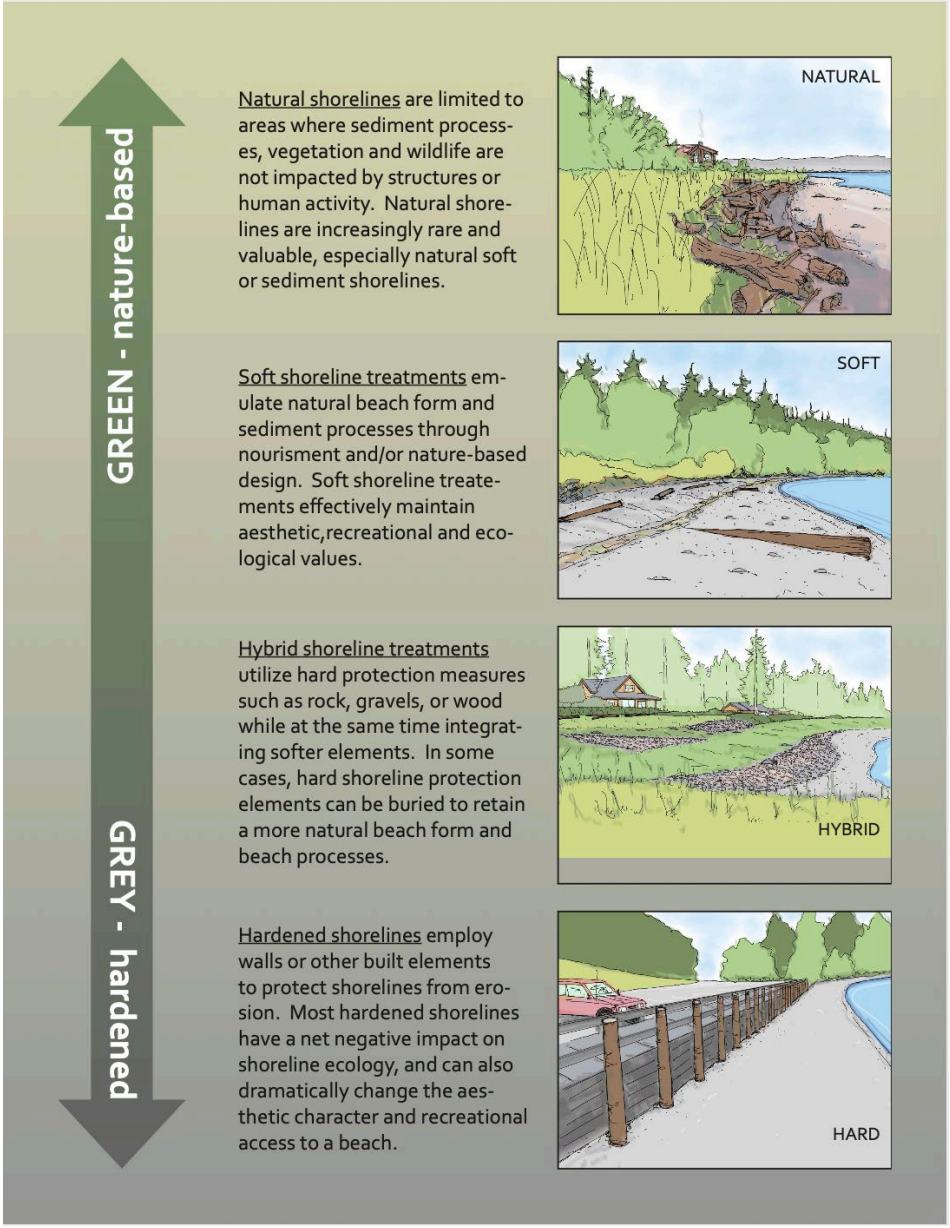


Figure 1.5.2: Spectrum of approaches from hard armouring to nature-based methods.

For the purpose of this credit, GSH defines two broad categories of nature-based approaches for shore protection:

Soft shore protection: shore protection design which entails the use of indigenous materials such as gravel, sand, vegetation, and woody debris (logs and root masses) in designs that have some degree of flexibility, mimicking natural processes (Johannessen et al., 2014). Soft shore projects typically look like natural shorelines in the area and have limited hard elements like rocks and logs. State and Federal regulatory structures in Washington State may restrict some types of nature-based methods and should be consulted to determine what a project can do. Hard elements can only be included in soft shore

designs if they reflect the type, configuration, and proportion of hard elements occurring on nearby natural shorelines.

Hybrid shore protection: Nature-based approaches where hard elements, such as oyster shells, logs, biologs/biomats (erosion-control products made of natural, biodegradable materials), or rocks are used to enhance the function of soft shore elements such as vegetation, sand, and gravel. Hard elements are minimized in size and extent and are carefully designed to limit their impact on coastal processes. Hard elements can also be buried below the soft shore to provide additional protection in the case of an extreme event. Hybrid approaches are generally used on shorelines with greater fetch and/or higher energy coastal processes. Hybrid shore protection projects have more environmental impact to shorelines than soft shore protection and natural, undisturbed shorelines but are designed to contribute ecological and coastal process benefits over hard structures.

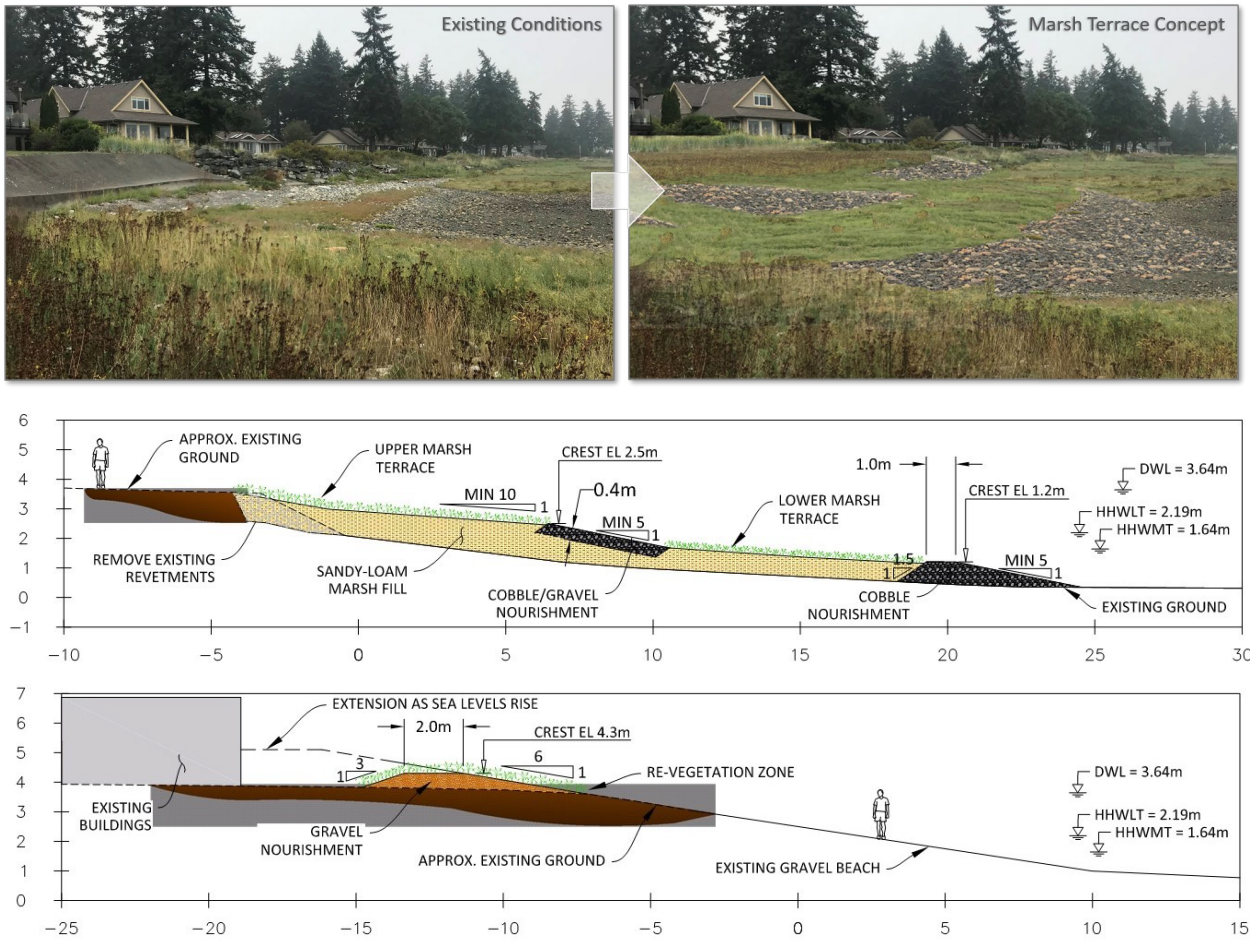


Figure 1.5.3. Example of a terraced marsh hybrid shore design concept (top) and cross sections (middle and bottom). *Credit: Northwest Hydraulic Consultants (NHC).*

Hybrid solutions, like NHC's terraced marsh design concept in Figure 1.5.3, are designed as nature-based designs for shoreline protection which uphold all four of the GS principles.

- Physical processes are managed in such a way that natural water and sediment movement is maintained.

- Shoreline habitat diversity and function is a critical component for the success of nature-based methods.
- Pollutants are prevented and reduced through the nature-based design and its vegetated component.
- Impacts to the shoreline environment are avoided or reduced in the design of nature-based design, resulting in reduced cumulative impacts.

Not all sites are suitable for nature-based shores and at sites that are suitable, not all nature-based methods are appropriate. Assessments (e.g., coastal processes assessment including climate change effects) to determine feasibility and/or site suitability for nature-based measures, site protection requirements, and appropriateness of nature-based design must be conducted by a Qualified Coastal Professional (QCP).

Will a nature-based method work for your property? The suitability of nature-based methods is dependant on physical and environmental conditions and every site is unique. Protected or low energy sites are usually suitable for nature-based designs while higher energy sites usually need to incorporate hard aspects into a hybrid design. Appendix E presents a useful starting point to begin thinking about nature-based shorelines on your property. Engaging a QCP early in your project is highly recommended.

Figure 1.5.4. The suitability of nature-based methods is limited by the amount of wave energy and the proximity of buildings to the shoreline. *Credit: Kelly Loch.*

Nature-based shoreline protection projects will likely require maintenance over their design life, depending on the level of activity of shoreline processes. Monitoring of the site following GSH Monitoring Guidelines (See Monitoring Guide) is strongly recommended, and bonus points are available for a commitment to monitoring (see section below: Points Available).

There are a variety of nature-based measures, including beach nourishment, logs and woody debris, bank re-sloping, and hybrid solutions. Appendix D provides a list of nature-based techniques.

Where this credit applies

This credit applies to marine and freshwater shores with sediment-based shorelines. **Adding soft or hybrid protection to a naturally rocky shore does not qualify for this credit.**

Using nature-based methods to address shoreline erosion is an environmentally friendly alternative to armouring; however, it is important to note that for a project to receive points for this credit, the site must:

- truly require shoreline erosion control to protect existing major buildings *OR*
- have degrading/degraded shore habitat that can be demonstrably enhanced by nature-based approaches *OR*

- have intact shore habitat that can be demonstrably protected by nature-based approaches.

If these criteria cannot be met, **soft or hybrid protection cannot be added just to qualify for this credit**.

The selection of hybrid shore protection in a GSH project is dictated by environmental and site conditions. If a hybrid shore is proposed, the following MUST be demonstrated:

- The site is unable to maintain soft shore protection alone due to environmental (e.g., fetch, energy) or site conditions (e.g., type or location of infrastructure, lot size) as determined by a QCP *AND*
- Hard element(s) are minimized (size and extent) as much as functionally possible and built from locally appropriate materials (i.e., sandstone in sandstone areas, oyster reefs where oysters are native).

This credit CANNOT be combined with:

- Credit 1.1 No Shoreline Protection Structures: Credit 1.5 refers to creating a soft shore as a protective measure whereas Credit 1.1 refers to leaving a natural shore (soft or hard) alone.
- Credit 1.3 Hard Armour Removal: you cannot get points for credit 1.5 as well as for a bulkhead removal EXCEPT if a bulkhead is removed from one portion of the shoreline (Credit 1.3) and another portion of the shoreline that was previously unprotected is treated with nature-based erosion and flood management methods (Credit 1.5).

NOTE that if you have a shoreline that is part hard armour removal and part nature-based management and are applying for both credits 1.3 and 1.5, you can apply for the bonus points regarding spawning/breeding habitat and a monitoring commitment under one of these credits only, not both.

Benefits

To the homeowner

Nature-based strategies can help to protect buildings that are threatened by erosion while avoiding the typically more expensive bulkhead and related types of engineering approaches. The use of nature-based as compared to hard approaches often results in increased resilience and potentially less maintenance in the long-term as vegetated components typically get better over time, while hard structures degrade over time. It has been found that nature-based shoreline protection can provide better erosion protection during a Category 1 hurricane than hard structures (Gittman et al., 2014 and Smith et al., 2018). The vegetation used in natural projects can filter pollutants such as sediment and nutrients providing water purification services and enhancing water quality.

Nature-based methods can have a greater aesthetic appeal, particularly once vegetation has been established and the site has naturalized. These projects typically also increase the available beach or salt marsh area, which allows for additional recreational and fish and wildlife observation opportunities while encouraging responsible shore access. All these effects improve property values.

To the environment

Nature-based strategies can provide effective erosion control on suitable sites where protection is required, while not impacting geomorphic processes or substantially degrading nearshore habitats.

Credit 1.5: Nature-Based Erosion & Flood Management

Properly designed nature-based shoreline projects work with natural conditions, and compared to hard shore protection, offer a suite of more desirable environmental outcomes. For instance, beach nourishment may provide spawning or breeding habitat for forage fish species (e.g., Pacific sand lance, surf smelt, lake-spawning sockeye salmon, silversides, and capelin), birds, and turtles. Soft shores provide habitat for invertebrates which are the food sources for salmon and other food fish species, birds, and marine mammals. Unlike bulkheads, beach nourishment contributes to natural sediment transport and shoreline habitats.

Nature-based shoreline projects can restore, or augment shoreline features to provide a net gain in shoreline habitat area and function, as well as ecosystem services such as carbon storage, water purification, and nutrient cycling. In some cases, nature-based measures can mitigate habitat loss when there are constraints that prevent restoration at the original sites. An example is the creation of a lagoon where a nearby historic lagoon had been filled in. These shoreline projects can re-create or restore habitats that have been degraded or lost from an area, provide novel and niche habitats that can increase species diversity, and methods like marsh sills and artificial reefs can provide refuge for fish and aquatic species.

Protected Species and Sensitive Habitat Considerations

Nature-based projects can be beneficial to or incompatible with protected species (Species at Risk in Canada or Endangered Species in US) and sensitive habitats depending on the needs of the species, the type of habitat, and the materials and/or methods used in the nature-based shore protection project. Seasonal timing of construction activities (i.e., to avoid migration or breeding seasons) can sometimes reduce impacts to protected species. See Category 2's "Further Reading" section on protected species and consult local authorities (e.g., Canadian Wildlife Service, US Fish and Wildlife Service, Department of Fisheries and Oceans) or experts for more information on mitigating impacts to specific species or habitats.

Points available

This credit offers up to 12 base points plus up to 4 bonus points.

Use soft shore measures instead of hard armouring for protection from erosion/flooding over*:	**Base points**
95-100% of the shoreline	**12**
75-94% of the shoreline	**11**
50-74% of the shoreline	**8**
30-49% of the shoreline	**5**
Use hybrid shore measures instead of hard armouring for protection from erosion/flooding over*:	**Base points**
95-100% of the shoreline	**9**
75-94% of the shoreline	**7**
50-74% of the shoreline	**5**
30-49% of the shoreline	**3**
Bonus (available once one of the base conditions has been met)	**Bonus points**

In areas where the beach and nearshore habitat have been degraded, provide documentation that the nature-based methods recreate, restore, or enhance spawning and/or breeding habitat for vertebrate (i.e., fish, birds) and/or invertebrate species.	**2**
Create an adaptive management plan	**1**
Bonus Monitoring (3 years post-construction)	**1**

* Note that the remaining % of the shoreline NOT subject to soft or hybrid shore measures cannot be bulkheaded but may have had a bulkhead removed and received points under Credit 1.3.

How to proceed

Nature-based shoreline projects must be designed and supervised by a Qualified Coastal Professional (QCP), preferably trained in Green Shores (GS Approved Professional[6]). The project must employ a design that allows for the continuation of natural ecological processes such as littoral drift and riparian vegetation growth while not completely altering beach or backshore areas. The Marine Shoreline Design Guidelines Decision Tree Tool (Appendix E) is a useful tool for identifying appropriate shore protection techniques for a given site.

In the US, project features (e.g., beach nourishment or marsh sills) that extend below the Ordinary High Water Mark (OHWM) must be reviewed by federal, state, and local regulatory agencies. Similarly, in Canada, any project features installed below the OHWM must be reviewed by federal authorities (Fisheries and Oceans Canada in relation to the *Fisheries Act* and Transport Canada in relation to the *Navigable Waters Protection Act*), reviewed by provincial land authorities (the foreshore is owned and managed by the Provincial Crown), and is subject to local government regulation.

If work is proposed in the foreshore (below the OHWM), approval from state, provincial, or federal fisheries or environment agencies is required. Also, any work in shoreline and riparian areas will likely be regulated at the local level (e.g., as “development permit areas”). Always consult with your local government to find out what approvals are needed.

Sensitive/Protected Species and Habitats: There may be restrictions on what activities can take place around protected species and their habitats. Consultation with a local wildlife biologist or ecologist is recommended if you are in an area with known protected species and/or sensitive habitat. If breeding habitat for species without legal protections (i.e., forage fish, shore birds) has been documented on the subject beach, nature-based projects must not bury these areas without designing in a suitable replacement. Grain size composition of beach nourishment sediments should match local conditions as closely as possible to ensure that habitat is enhanced rather than degraded. The project site should be monitored as per GSH Monitoring Guidelines to ensure that breeding habitat is preserved or enhanced.

See Appendix D for examples of nature-based shoreline protection.

Monitoring

- Pre-construction, post-construction and third year monitoring:

[6] For BC residents, a list of Green Shores Approved Professionals can be found at: https://stewardshipcentrebc.ca/green-shores-home/gs-resources/gs-approved-professionals/.

  - Provide photographs before and after construction from the same vantage points, showing the nature-based method.
  - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.
- Bonus monitoring: See Monitoring Guide for details.

Submittals

Project proponents must complete the following to qualify for this credit:

1. Complete all documentation required in the Nature-Based Project Checklist (Appendix F)
2. Site Design Plan (Prerequisite 2) showing:
    a. Type, location, area, length, and elevation of nature-based method.
    b. Calculation of percentage (%) of shoreline treated with soft and/or hybrid shore measures.
3. Completed Project Report following requirements outlined in Project Report Checklist (Appendix F).
4. Completed Project Report Checklist (Appendix F).
5. Photo documentation before and after construction.

If applying for monitoring bonus points:

6. Letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Credit 1.6: Managed Retreat

To qualify for this credit, move existing buildings inland to help prevent shoreline erosion and adapt to ongoing or predicted shoreline recession.

Figure 1.6.1. Relocation of house back from eroding coastline on New Zealand's west coast. *Credit: New Zealand Ministry of Environment (2008).*

Moving buildings inland will avoid the need for shore protection and other negative impacts associated with managing erosion in the future.

Where this credit applies

This credit applies to any site where buildings are at risk from shoreline erosion. It applies to marine and freshwater shores, and particularly marine shores that are subject to sea level rise and shoreline recession.

This credit applies to both Major Buildings (permanent houses or buildings used for human habitation) and Minor Buildings (secondary buildings not intended for human habitation such as a garage, shed, boathouse, gazebo, patio, deck, etc.).

Retreat should only be considered or recommended if the building in question can be moved to a location that is above the area affected by shoreline erosion/recession predicted to occur within 80 years or the life of the building, whichever is greater. Also, only consider retreat if the property is large enough to allow this move without compromising other legal setback requirements, or if the building can be relocated off the property.

This credit cannot be combined with Credit 1.2 for the same building(s).

Benefits

To the homeowner

Moving a building avoids substantial short or long-term expenses for shore protection and the loss of valuable assets. Moving a building within a lot can often cost less than installing protective works.

Credit 1.6: Managed Retreat

To the environment

Moving major buildings allows the homeowner to avoid an array of negative impacts on shoreline processes and habitats that comes with construction and maintenance of shore protection and other erosion control measures. This single action, although not necessarily the easiest, provides long-lasting benefits such as space for natural shoreline movement and increased coastal resilience.

Points available

This credit offers up to 10 base points plus up to 2 bonus points.

Managed retreat	Base points
Move an existing major building* to a location that is above the area affected by shoreline erosion and recession predicted to occur within 80 years or the life of the building, whichever is greater.	**8**
Move an existing minor building** to a location that is above the area affected by shoreline erosion and recession predicted to occur within 80 years or the life of the building, whichever is greater	**2**
Bonus (available once one or more base conditions have been met)	**Bonus points**
Add the effects of sea level rise into determining the relocation of a major or minor building.	**2**

*Major building refers to a permanent house or dwelling.
**Minor building includes garage, boathouse, shed, etc.

How to proceed

To meet this credit requires:

- A site plan that shows the original building footprint and the site to which the building has been or will be relocated. The relocation site must be landward of the area affected by projected erosion for 80 years or the life of the building, whichever is greater. General rules of thumb for an adequate distance are 10m/35ft from the predicted receded Ordinary High Water Mark (OHWM), Higher High Water Large Tide (HHWLT), or Natural Boundary (NB), or receded bluff/bank edge for low to moderately eroding sites, and 20m/70ft for rapidly eroding sites.
- To include climate change-induced sea level rise, determine what the projected SLR is for your area (see 'Further Reading' section). Determine how this will change the location of the OHWM/HHWLT/NB over 80 years or life of the building (whichever is greater) and determine the relocation site accordingly.

Measurements of planned/existing building setbacks and the usable space available for moving the buildings back would have to be assessed and quantified both from project drawings and in the field. This involves simple linear measurements and does not require any special qualifications other than judging where suitable land is available.

Monitoring

- Pre- and post-construction:

- Provide photographs before and after construction from the same vantage points, showing the nature-based method.
- Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing original footprint of building being moved and current OHWM.
2. Site Design Plan (Prerequisite 2) showing:
    a. Location of OHWM or bank/bluff edge in 80 year or life of building (whichever is greater).
    b. Footprint of relocated building accounting for above prediction.
3. Photo documentation of building before and after relocation

If applying for bonus point:

4. Site Design Plan (Prerequisite 2) showing:
    a. Predicted location of OHWM or bank/bluff edge with SLR by 2100.
    b. Footprint of relocated building accounting for both the 80-year recession and SLR predictions.

Category 1: Further Reading

Category 1: Shoreline Processes

General

Center for Coastal Resource Management (CCRM). (2022). *Self-Guided Decision Tools.* https://www.vims.edu/ccrm/ccrmp/bmp/decision_tools/index.php

Gittman, R.K., Popowich, A.M., Bruno, J.F., and Peterson, C.H. (2014). Marshes with and without sills protect estuarine shorelines from erosion better than bulkheads during a Category 1 hurricane. *Ocean & Coastal Management, 102*(A), 94-102. https://doi.org/10.1016/j.ocecoaman.2014.09.016

International Union for Conservation of Nature (IUCN). (2021). *Commission on ecosystem management.* https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions

Mangor, K. (2021). *Detached breakwaters.* http://www.coastalwiki.org/wiki/Detached_breakwaters

National Atmospheric and Oceanic Administration (NOAA). (2020). *NOAA's Living Shoreline Projects.* [Storymap] https://www.habitatblueprint.noaa.gov/storymap/ls/index.html

National Atmospheric and Oceanic Administration (NOAA). (2015). *Guidance for considering the use of living shorelines.* https://www.habitatblueprint.noaa.gov/wp-content/uploads/2018/01/NOAA-Guidance-for-Considering-the-Use-of-Living-Shorelines_2015.pdf

Naturally Resilient Communities, (n.d.). *Solution: Living Breakwaters.* [Factsheet] http://nrcsolutions.org/wp-content/uploads/2017/03/NRC_Solutions_Breakwaters.pdf

Smith, C.S., Puckett, B., Gittman, R.K., and Peterson, C.H. (2018). Living shorelines enhanced the resilience of saltmarshes to Hurricane Matthew (2016). *Ecological Applications, 28*(4), 871-877. https://doi.org/10.1002/eap.1722

Systems Approach to Geomorphic Engineering (SAGE). (2020). *Science and Engineering: Technical guidance*. http://sagecoast.org/info/sci-eng.html

Visit the Green Shores website for more region-specific resources.

Category 2: Shoreline Habitats

The Shoreline Habitat credits encompass actions that protect, enhance, or restore shoreline habitat, including aquatic and riparian habitats. For our purposes, shoreline habitat includes:

- the subtidal zone (in marine environments) or the littoral zone (in lake environments) to a depth of 10m/35ft below datum;
- the foreshore or intertidal zone; and
- the riparian and backshore up to 60m/200ft from the Ordinary High Water Mark (OHWM) or Natural Boundary (NB; see Glossary) or Higher High Water Large Tide (HHWLT).

In this section:

Credit 2.1: Enhanced Critical, Sensitive, or Migratory Bird Habitat Stewardship

To qualify for this credit, you must have critical, sensitive, or migratory bird habitat on the property, and take extra steps to minimize disturbance to these species and habitats.

Species at risk are species that are at risk of extinction or disappearing, and the level of this risk can vary by species and jurisdiction. Species at risk are generally assessed at federal and provincial/state levels as: extinct, extirpated, endangered, threatened, or special concern and require protection. Sensitive habitats can include federally, provincially, or regionally designated Environmentally Sensitive/Significant Areas, Protected Natural Areas, National Parks, and Nature Reserves. They can also include valued foreshore habitats, commercial/recreational/First Nation clam beds, tidal channels, important spawning and rearing areas for fish, seabirds, and marine mammals. See Prerequisite: Critical and Sensitive Habitat to meet basic requirements for critical or sensitive habitat.

- Critical habitat as identified under *SARA*: "habitat necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or action plan for the species."
- In the Maritime Provinces, Core Habitat is identified under the Nova Scotia *Endangered Species Act*, and in New Brunswick, habitat is described in the recovery strategy for species at risk under the New Brunswick *Species at Risk Act*. Prince Edward Island does not have legislation specific to species at risk, but some protection may be implemented from the *Wildlife Protection Act*.
- In BC, habitat is defined as areas providing important feeding, resting, spawning, nesting, or rearing habitat for species designated under the *BC Wildlife Act*, or identified as "red" or "blue" listed species by the BC Conservation Data Centre.[7]

In Washington State, this includes:

- Critical habitats identified under the United States *Endangered Species Act* (ESA).
- Priority species habitat identified by the Washington Department of Fish and Wildlife (WDFW) in the *Growth Management Act*.
- Critical areas and critical salt water and freshwater habitat defined by the Shoreline Master Program (SMP) Guidelines (WAC 173-26).
- Under the SMP, critical saltwater habitats include kelp beds; eelgrass beds; spawning and holding areas for forage fish such as herring, smelt and sand lance; subsistence, commercial and recreational shellfish beds; mudflats; intertidal habitats with vascular plants; and areas with which priority species have a primary association.
- Also, from the SMP, critical freshwater habitats include those portions of streams, rivers, wetlands, and lakes, their associated channel migration zones, and flood plains designated as such.

[7] The designation of habitat as red or blue in BC can be found at: https://a100.gov.bc.ca/pub/eswp/.

Migratory Birds

In Canada, Environment and Climate Change Canada is responsible for protecting and conserving the vast majority of bird species encountered in the country, specifically those protected by the *Migratory Birds Convention Act, 1994* (MBCA) and Migratory Birds Regulations.

The MBCA protects migratory birds, their nests, and eggs anywhere they are found in Canada. While some species are not protected by the MBCA, most are covered under other provincial wildlife acts. Some bird species are also protected by other federal (*Species at Risk Act*) or provincial/state species at risk legislation (see Further Reading at the end of Category 2).

Migratory birds, their nests, and their eggs can be harmed by activities such as physical disturbances (e.g., tree clearing, construction) and sensory disturbances (e.g., noise and light pollution). The time periods when birds might be nesting on or migrating over the property must be determined so activities can be scheduled to reduce the risk of harm.

The regional nesting period of the project area can be found using the interactive map in the link below.

https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html

Any construction activities that may disturb migratory birds should occur outside the regional nesting period. There are additional protective measures for species that reuse the same nest or nesting area. For the seasons where birds are migrating over the property, ensure all outdoor lighting is not directed towards the sky. Light pollution is a major issue for migratory species during both breeding and migration, and can alter behavioural patterns that may affect the success of the breeding/migration season, such as foraging behaviour or parental behaviours. Many species rely on natural nighttime light from the moon and stars as navigation tools for migration, but artificial lights, especially on cloudy or foggy nights can disorient species and direct them towards the light source rather than their intended foraging or migration destination (CPAWSNL, n.d.). Birds especially become disoriented and end up wasting energy trying to orient themselves, which makes them vulnerable to collisions and predation (National Audubon Society, n.d.).

Recommended actions that minimize light pollution for migratory species:

- Extinguish spotlights and floodlights.
- Turn off interior lighting on upper levels of taller buildings, or pull window coverings.
- Install motion sensors wherever possible.
- Assess what intensity of lighting is needed; limit outdoor LED lightbulbs to a maximum of 3,000K colour temperature (warm white on the Kelvin colour temperature scale) (Portland Audubon, 2020).

Where this credit applies

This credit applies to all projects and shoreline types where critical habitats, sensitive habitats, or migratory birds are present and recognizes efforts to provide enhanced stewardship and maintenance of these habitats and the species that occupy them. **The stewardship bonus point under this credit cannot be combined with education measures under Credit 4.2, nor can it be combined with joining an environmental program under Credit 4.4.**

Credit 2.1: Critical and Sensitive Habitats

Benefits

Many property owners have a shared interest in protecting biodiversity and ensuring healthy ecosystems today and for future generations.

To the homeowner

Minimizing disturbance to migratory birds, species at risk, and their habitats preserves your investment in what drew you to living on the shoreline.

To the environment

Stewarding species at risk and migratory birds helps to maintain and recover native plant and wildlife populations, and with that, biodiversity.

Points available

This credit offers up to 6 base points plus up to 2 bonus points

Critical and sensitive habitats are present.	**Base points**
Project work is **NOT** occurring in critical habitat or habitat suitable for species at risk, **and** an additional setback distance (see How to Proceed) is being applied and incorporated into the project plans to minimize potential impacts to these habitats.	**3**
Project work is **NOT** occurring in sensitive habitat, **and** an additional setback distance (based on the habitat and the activity) is being applied and incorporated into the project plans to minimize potential impacts to these habitats.	**2**
Project work/activities that could disturb migratory birds are scheduled to occur outside the general nesting period **and** practices that negatively impact migration are avoided/mitigated (e.g., shoreline/property lighting).	**1**
Bonus (available only if one of the base conditions above is met)	**Bonus points**
A stewardship bonus point is available if you work with a local conservation group to help raise public awareness regarding actions homeowners can take for the conservation of species at risk and migratory birds (e.g. signage on your property or by volunteering your property to serve as a case study for Green Shores training).	**1**
Annual monitoring of habitat quality and species observed (Every year for 3 years)	**1**

How to proceed

After ensuring that your project meets Prerequisite: Critical or Sensitive Habitat, add an additional buffer to your design plans. A buffer will help minimize impacts to these habitats. An appropriate buffer

can be determined with the help of a biologist/ecologist. The buffer is determined by several factors such as the level of disturbance, the landscape context, and the species and habitats present.

Plan for disruptive project activities to occur outside the regional nesting and migration periods for migratory birds.

Work with a local conservation group to help raise public awareness regarding actions homeowners can take for the conservation of species at risk and migratory birds (e.g., signage on your property or by volunteering your property to serve as a case study for Green Shores training).

Monitoring

- Pre-construction, post-construction, and three-year monitoring
    - Provide photographs before and after construction from the same vantage points, showing the buffer for species at risk, sensitive habitats or migratory bird habitat.
    - Photograph IDs according to instructions in the Monitoring Guide and any additional notes about the area that might be of interest.
- Bonus monitoring: See Monitoring Guide for details.

Submittals

For this credit, you will need to provide:

1. Existing Conditions Plan (Prerequisite 1) showing the location of any species at risk habitats, sensitive habitats, and/or migratory bird habitats (include species name(s)).
2. A Site Design Plan (Prerequisite 2) showing location, width, and description of associated setbacks on your property.
3. Documentation, prepared by a Qualified Environmental Professional, that species at risk habitats, sensitive habitats, and/or migratory bird habitats are present and that enhanced buffers and mitigation actions have been applied.
4. If applicable, a proposed project design and/or schedule demonstrating that project activities that may disturb migratory birds are scheduled to occur outside of the regional nesting and migration periods.

If applying for bonus points:

5. A brief explanation (1 paragraph) of the stewardship program/group in which the applicant/project is involved AND/OR
6. A brief explanation (1 paragraph) of any information/education measures, as applicable (e.g., signage, demonstrations, tours) AND
7. A photo or copy of the information/education measures, as applicable (e.g., poster, news article, tour, or classroom session) AND/OR
8. A letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Credit 2.2: Riparian and Emergent Vegetation

To qualify for this credit, maintain existing or plant new native vegetation in the riparian area and nearshore to help conserve or enhance the ecological functions that it provides along the shoreline.

Riparian areas where land and water converge are among the most biodiverse of any habitats. Riparian vegetation is usually influenced by the moisture regime in the soil adjacent to the waterbody and in turn influences the ecology of the adjacent waterbody. For the purpose of this guide, riparian vegetation is trees, shrubs, and ground cover that exists or is planted up to 60m/200 ft landward of the Ordinary High Water Mark (OHWM)/ Higher High Water Large Tide (HHWLT)/Natural Boundary (NB).

Figure 2.2.1. From this… …to this. *Credit: The Watershed Company.*

Emergent vegetation is defined as vegetation that grows in partially submerged conditions in freshwater or estuarine/brackish environments. Examples of emergent plants are cattails (*Typhus* spp.), bulrushes (*Scirpus/Bolboschoenus/Schoenoplectus* spp.) and sedges (*Carex* spp.) in freshwater environments; and sedges, pickleweed (*Salicornia* spp.), cordgrass (*Sporobolus/Spartina* spp.), and salt grass (*Distichis* spp.) in estuarine environments. Marine intertidal vegetation such as rockweed (*Fucus*) and eelgrass (*Zostera*) are not considered to be emergent vegetation with respect to this credit.

Native vegetation is preferred for shorelines because native species:

- are better adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance,
- are usually in balance with most pests and diseases in the local landscape,
- require little or no irrigation or fertilizers, once established,
- are non-invasive (do not dominate to the extent of excluding all other species), and
- usually provide better food sources for native fish and wildlife.

However, mature non-invasive or native-adapted plant species may be maintained if they provide the same or similar ecological functions.

Credit 2.2: Riparian and Emergent Vegetation

Overhanging shoreline vegetation in both marine and lake shores provides important organic input to the aquatic environment. Research in Puget Sound, Washington has shown that up to 40% of juvenile chinook food items are terrestrial in origin, much of it falling or blowing into the water from nearshore vegetation. In addition, surf smelt tend to spawn in beach areas with overhanging vegetation.

In lakes, native emergent vegetation such as cattails, sedges, and rushes as well as clusters of fine woody debris provide important nearshore cover for juvenile fish, including salmon. Salt marshes also provide habitat for many bird species in Washington, BC, and the Maritimes.

Figure 2.2.2. Typical lake shore with overhanging vegetation. *Credit: Herrara Environmental Consultants.*

Where this credit applies

This credit applies to all types of projects on a waterfront property, but particularly development occurring within and adjacent to riparian areas. It applies to any type of shore in both marine and lake environments. The characteristics of riparian and emergent vegetation are somewhat different in marine versus freshwater shorelines, but it serves the same functions and generates the same benefits in either situation.

Figure 2.2.3. Juvenile coho salmon in submerged vegetation. *Credit: P. Law.*

Benefits

The goal is to have functioning riparian and emergent vegetation along the shoreline, consistent with the natural soil, climate, and flora and fauna characteristics of the site.

Figure 2.2.4. Overhanging vegetation on marine shore *Credit: H. Rueggeberg.*

To the homeowner

Riparian and emergent vegetation provides natural shoreline stabilization and is less expensive than installing hard shoreline armour. Retaining existing native vegetation saves on landscaping costs; the maintenance of vegetation is also less expensive than the maintenance of hard shoreline structures. Maintaining riparian vegetation may help avoid the need to install costly stormwater treatment facilities and home air quality systems. Riparian vegetation attracts birds, fish, and other wildlife for viewing. A healthy riparian area offers better aesthetics, noise reduction and increased privacy, and higher property value.

To the environment

Protection or re-establishment of riparian and emergent vegetation provides key ecological features, functions, and values of shoreline habitats and maintains the high biodiversity of riparian areas. Riparian vegetation with its associated network of branches, trunks, stems and roots:

- provides water quality and quantity benefits by enhancing the infiltration and retention of rainwater,
- delivers woody material as habitat for fish and other aquatic organisms,
- delivers food sources such as insects and leaf detritus for the aquatic food web,
- moderates temperature in the riparian area for climate-sensitive plant and wildlife species, as well as in the beach substrate where forage fish spawn,
- stabilizes shoreline banks. The roots of riparian vegetation hold soils and maintain shoreline bank integrity,
- provides habitat for birds and terrestrial animals, and cover for juvenile salmonids to avoid predation by birds, and
- can help dissipate wave energy on shallow slopes, thus moderating erosion and supporting the accumulation of beach sediment.

For more information on how protecting and enhancing ecological benefits on private property increases property value, read: *The Economic Benefits of Protecting Healthy Watersheds* (see Further Reading).

Points available

This credit offers up to 9 base points plus up to 4 bonus points

Although the riparian area can be up to 60m/200ft this denotes generally where the riparian zone occurs, whereas points for this credit can be applied for restoration within the riparian buffer (RB). The RB is the shoreline area that lies within the minimum riparian buffer or setback required by the local jurisdiction OR within 10m/35ft of the OHWM (measured as the horizontal distance landward of the OHWM), **whichever is greater.**

Riparian vegetation	Base points
Maintain and/or plant native vegetation in 75-100% of the RB	**7**
Maintain and/or plant native vegetation in 50-74% of the RB	**5**
Maintain and/or plant native vegetation in 30-49% of the RB	**2**
Retain or plant overhanging and/or emergent vegetation along ≥50% of the shoreline length	**2**
Retain or plant overhanging and/or emergent vegetation along ≥25-49% of the shoreline length	**1**
Bonus (available once one or more base conditions have been met)	**Bonus points**
Maintain and/or plant native vegetation in additional 10ft (3m) width inland from the riparian buffer for the length of the shoreline, *or equivalent*. Equivalency may be measured as greater than 10ft (3m) additional width over less than the entire shoreline.	**1** bonus point per 3m/10ft of additional width of riparian vegetation, up to a maximum of **3** bonus points (i.e., 9m/30ft of

	additional riparian vegetation width)
Provide and implement a plan for monitoring and maintaining your riparian plantings. Complete Vegetation Survey as per monitoring guide.	**1**

How to proceed

First have a look at the vegetation that may already be on site. Riparian vegetation may be present year-round, but emergent vegetation typically goes dormant in winter; it is important to examine the site in summer to determine whether emergent vegetation is present. For example, some lakeshores in Nova Scotia have a community of small emergent plants that can contain rare species (Atlantic Coastal Plain Flora, Figure 2.2.5).

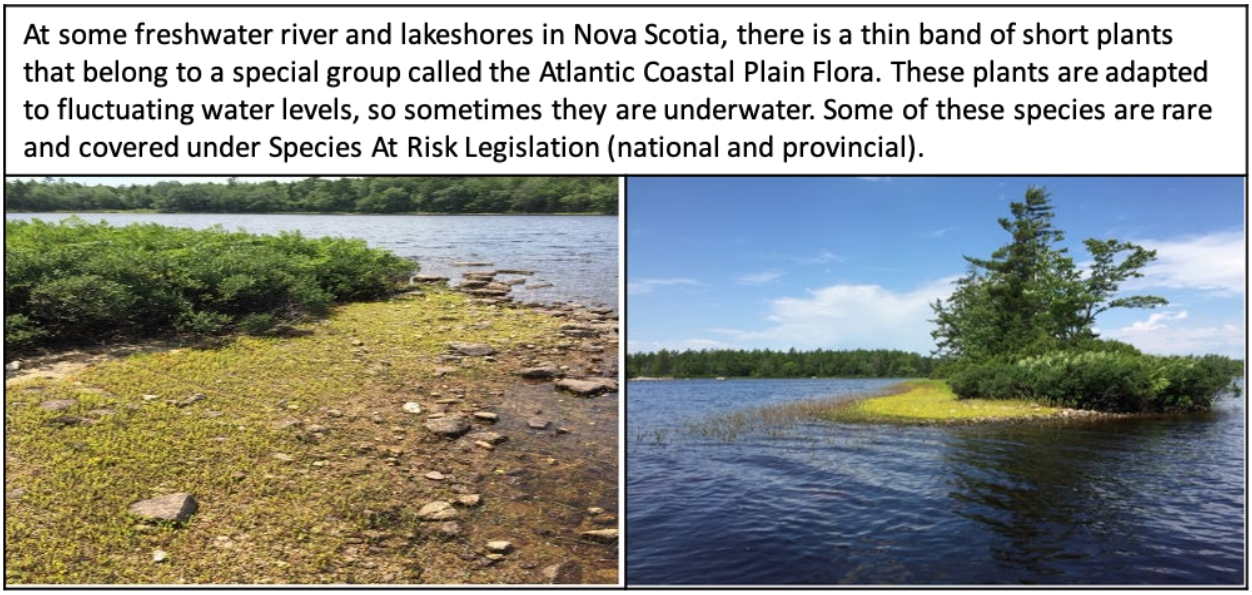


Figure 2.2.5. Atlantic coastal Plain Flora, Nova Scotia.

If planting makes sense as part of your restoration plan, choose native species that are suitable to your site. As much as possible, planting should be comprised of multi-storied vegetation that includes trees, shrubs, and ground cover; however, in some environments, such as south facing rocky bluffs with thin dry soils, only shrubs, grasses and other ground cover may be suitable. In sites with low elevations relative to water levels, emergent herbaceous vegetation may be preferred.

Mature non-invasive non-native or “native adapted” plant species can be maintained as they provide some ecological functions; however, avoid planting new non-native species. Example plant species lists, for lakes and marine shorelines on Pacific and Atlantic coasts, are provided in Appendices G1-G4.

Space plants to achieve full vegetation coverage within 10 years. For example, space trees at 2.4-4.2m/8–14ft on centre and shrubs at 0.6-1.8m/2–6ft on centre depending on the plant species. You may

need some assistance from a landscape architect, restoration biologist or landscaper with riparian planting experience to determine the best species and spacing to achieve the desired effect.

Planting density can vary considerably depending on factors such as aesthetics, nursery stock size at the time of planting and expected mature plant size. As a guide for typical riparian vegetation restoration plantings, plants should be no further apart (on center) than:

- grasses and forbs, including emergent vegetation – 0.3-0.6m/1-2ft using 4" pots or 0.6-0.9m/2-3ft using 1-gallon pots or larger.
- Shrubs – 1-1.5m/3-5ft depending on species and using minimum 2-gallon pots.
- trees – 3-4m/10-14ft depending on species and using minimum 5-gallon pots.

Note that clustering of trees and shrubs within the designated riparian zone is permitted as long as the overall plant densities follow the guidance provided above. See Further Reading for reference on planting guidance.

Retain and/or plant overhanging vegetation that extends out over the water. For example, trees such as alder, native maples, and willows and tall shrubs such as ocean spray and red-osier dogwood are excellent overhanging species. Avoid the use of heavy machinery to avoid ground compaction, destruction of existing vegetation, and the clearing of otherwise unnecessary paths.

On lake shores, retain existing or plant native emergent vegetation as much as possible. Emergent vegetation are plants that thrive in partially or temporarily submerged conditions. For example, along lake shores some emergent species are cattails, bulrushes, and sedges. They create excellent rearing and feeding habitat for juvenile forage fish and salmon. In lake shore properties, consider dedicating a section of your shore as juvenile fish rearing habitat by planting emergent vegetation and adding clusters of branches along the high water mark (see Credit 2.5). However, in managed lakes where water levels may fluctuate significantly on an annual basis, emergent vegetation may be difficult to maintain; check with local expertise on appropriate native species and location of planting to support their survival.

Monitoring

- Pre-construction, post-construction and third year
    - Provide photographs before and after construction from the same vantage points, showing the riparian and emergent vegetation.
    - Photograph IDs according to instructions in Monitoring Guide and any additional notes about the area that might be of interest.
- Bonus monitoring: See Monitoring Guide for instructions.

Submittals

Project proponents must complete the following to qualify for this credit:

1. Existing Conditions Plan with:
    a. Riparian buffer.
    b. Riparian vegetation type and extent.
2. Site Design Plan prepared to scale showing:
    a. extent and description of vegetation to be retained or planted.

   b. calculation of total m^2 of riparian area for pre-construction and post-construction.
3. Photo documentation of riparian zone before and after construction.

If applying for bonus points:

4. Site Design Plan (Prerequisite 2) showing vegetation maintained and/or planted an additional width inland.
5. Letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Credit 2.3: Trees and Snags

To qualify for this credit, preserve existing trees and shrubs, including standing dead trees (snags), or plant new trees in the riparian area.

Figure 2.3.1. Trees and snags. *Credit: B. Emmett (left), N. Faghin (right).*

Where this credit applies

This credit applies to all types of projects and shore types. Emphasis is on retaining trees, shrubs, and snags in riparian areas.

Benefits

To the homeowner

Trees provide shade from the sun and shelter from winds. Their roots assist with soil retention and bank stabilization. Trees filter air pollutants and provide us with oxygen. Trees also reduce surface runoff by breaking rainfall on their leaves, absorbing or transpiring much of the water, or directing it down the trunk and into the ground. This helps to prevent stormwater from carrying pollutants into the receiving lake or sea. Trees, both living and dead, create beautiful landscapes while providing increased fish and wildlife viewing opportunities.

To the environment

Both living and dead trees provide valuable feeding, nesting, resting, and hiding habitat for birds and small mammals. Trees that overhang the water along shorelines are especially valuable as they provide food and shelter for a range of terrestrial and marine biota. Living trees absorb carbon dioxide, removing and storing the carbon while releasing oxygen, thereby helping with the reduction of greenhouse gases, among a whole range of other additional benefits to the environment. In essence, trees are a hugely important shoreline landscape element and contribute in beneficial ways to shoreline habitats and ecology.

Points available

This credit offers up to 5 base points. For the purpose of this guide, riparian buffer (RB) is the shoreline area that lies within the minimum riparian buffer/setback required by the local jurisdiction OR within 10m/35ft of the OHWM (measured as the horizontal distance landward of the OHWM), **whichever is greater.**

Trees and snags	Base points	
	For lots <1000m²/ ¼ acre	For lots <1000m²/ ¼ acre
Retain existing trees of minimum size 10cm/4" DBH (diameter at breast height) within the RB OR Plant new trees of minimum size (conifers minimum 2.5m/8ft height; deciduous trees minimum 5cm/2" caliper and minimum 2.0m/6.5ft height) in the RB. If nursery stock of this size is not available, plant maximum size available locally.	**1** point per existing or new tree to maximum of **4** points	**1** point per two existing or new trees to maximum of **4** points
Retain a minimum of two snags/acre on the property; for properties less than 0.4 hectare/1 acre, retain a minimum of one snag. Snags must be 15 cm/6" DBH and a minimum 4m/12ft in height.	**1**	

How to proceed

Living trees do not have to be very large to provide the many benefits listed above. When doing any project work, protect the tree and its roots from damage by installing a construction fence at the drip line around the tree to exclude soil disturbance and heavy equipment. Use trees to frame views to the water.

Figure 2.3.2 Trees and snags *Credit: H. Rueggeberg.*

Evaluate existing dead standing trees on the site for their potential as wildlife trees. According to Santiago and Rodewald (2004), large snags (greater than 38cm/15in diameter at breast height and taller than 1.8m/6ft) are required for larger species such as certain woodpeckers; smaller birds and animals may use snags or dead limbs from 10cm/4in in diameter. Generally, the ecological value of a snag tree increases as its size increases. The species of snags retained should reflect the native trees found in the area.

Landowners may need to consult a professional arborist when determining if a snag presents a substantial hazard, particularly given the relative location of the snag to existing or proposed buildings. If removal must occur, remove only unwanted portions of the trees; this allows the remaining portions to provide valuable wildlife habitat. Remember that trees and snags are part of functional riparian vegetation (Credit 2.2).

Appropriate planting methods and protection (from deer and other browsers) for newly planted trees can be critical for the success of plantings (see Figure 2.3.3).

Credit 2.3: Trees and Snags

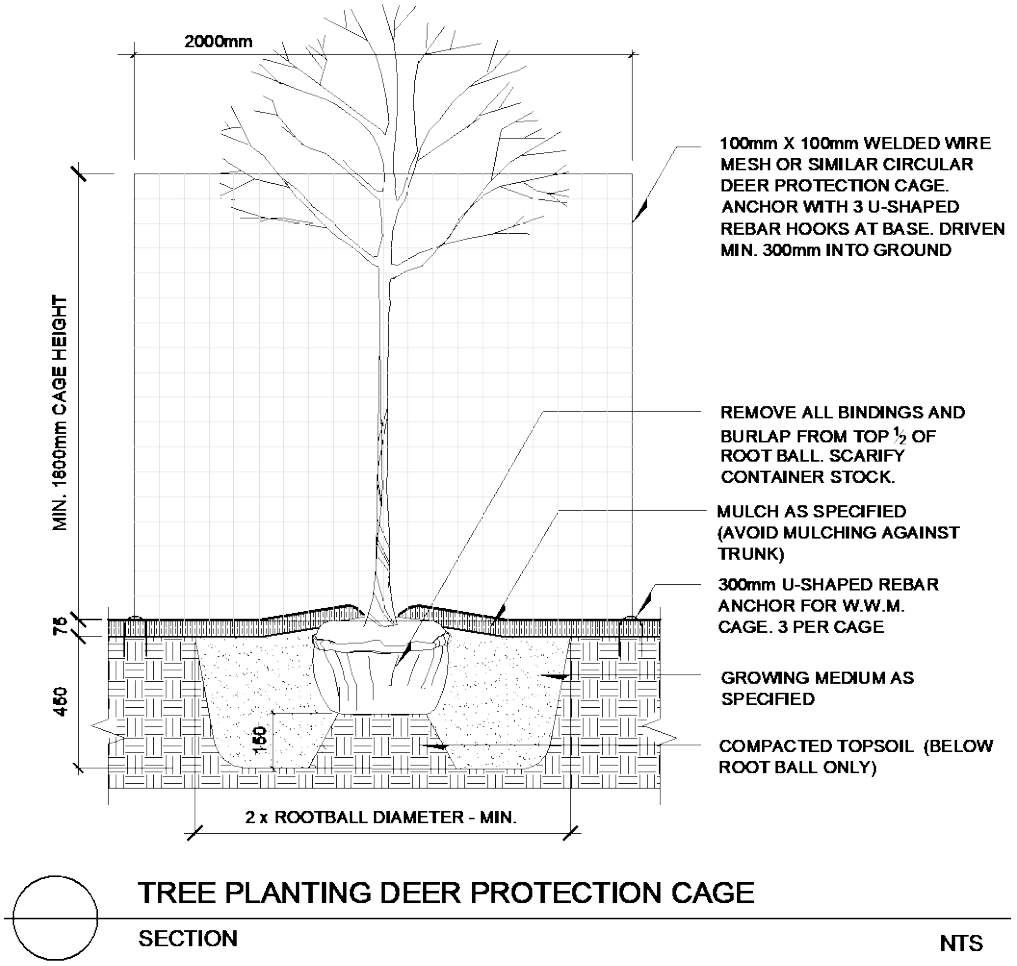


Figure 2.3.3. Planting and deer protection methodology for riparian tree plantings.

Monitoring

- Pre-construction:
    - Take representative photographs of trees and snags that you are going to retain on the property.
- Post-construction:
    - Take photographs of the same trees and snags retained from prior to construction.

Submittals

1. Existing Conditions Plan (Prerequisite 1) with:
    a. Existing trees and snags.
    b. Size (DBH) and species.
2. Site Design Plan (Prerequisite 2) with:
    a. Trees and snags retained (note any pruning/limbing).

   b. Size, species, and location of any new trees.

3. Photo documentation of new and retained trees and snags (before/after).

Credit 2.4: Invasive Plants

To qualify for this credit, remove, reduce, and manage invasive vegetation and noxious weeds.

This credit recognizes efforts to remove invasive or noxious vegetation and re-plant with native vegetation (see Credit 2.2 Riparian and Emergent Vegetation). Some common invasive plants are noted below (for more detailed inventories and information on invasive/noxious species and their management, see Further Reading).

Scotch broom (*Cytisus scoparius)*

Hydrilla (*Hydrilla verticillata)*

Purple loosestrife (*Lythrum salicaria)*

Tamarix or Saltcedar (*Tamarix ramosissima)*

Butterfly bush (*Buddleia davidii)*

Water chestnut *(Eleocharis dulcis)*

Himalayan blackberry (*Rubus armeniacus)*

Common reed *(Phragmites australis)*

Figure 2.4.1. Common invasive plants on Pacific NW shorelines *Sources: Washington Invasive Species Council, www.invasivespecies.wa.gov; Invasive Species Council of BC, www.bcinvasives.ca.*

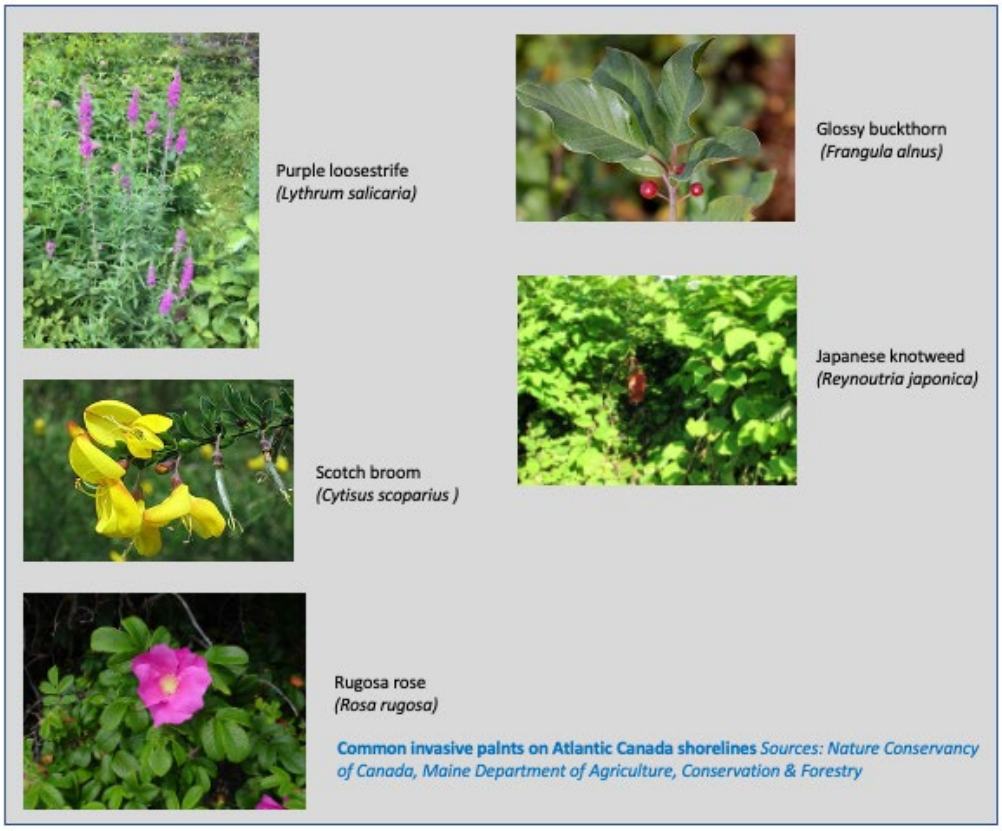


Figure 2.4.2: Common invasive plants on Atlantic Canada shorelines. *Sources: Nature Conservancy of Canada, Maine Department of Agriculture, Conservation & Forestry.*

While it is possible to eradicate some invasive species[8], others can only be reduced and then managed to contain or curtail their spread. In most cases, management and eventual eradication is an ongoing and long-term effort.

What is an Invasive Species?
An introduced, non-native organism (disease, parasite, plant, or animal) that causes harm to the environment, economy, or to human, plant or animal health. Non-native species are plants and animals living in areas where they do not naturally exist but to not cause harm. For example, lawn grass or cultivated tomatoes are non-native but not invasive.

Where this credit applies

This credit applies to whole-site and shoreline/riparian development, on any shore type and in either marine or lake environments.

This credit refers to invasive plants above the Ordinary High Water Mark (OHWM); i.e., in the riparian and upland portions of a property. At this time, removal of invasive species below the OHWM in fresh or marine systems is not addressed by this credit.

[8] NPS 2021: https://www.nps.gov/subjects/invasive/what-are-invasive-species.htm.

Credit 2.4: Invasive Plants

Benefits

To the homeowner

Benefits are similar to those noted for Credit 2.2 Riparian and Emergent Vegetation. In general, removing invasive vegetation and replacing with native plants:

- Provides better aesthetics, noise reduction, and increased privacy once the planted areas have matured — all of which increase property values.
- Prevents damage to other vegetation you wish to maintain.
- Results in lower maintenance landscapes.
- Creates greater fish and wildlife watching opportunities.

To the environment

In addition to those benefits associated with maintaining and restoring native vegetation described in Credit 2.2 Riparian and Emergent Vegetation, this credit is intended to restore natural ecological functions. In general, removing invasive vegetation:

- Improves and restores habitat and species diversity. Invasive vegetation results in mono-cultures that out-compete native species.
- Improves food sources for native birds and animals. It has been shown that detritus feeding organisms may not be adapted to the leaf fall patterns or the chemical characteristics of leaves from non-native trees suggesting that riparian areas are most effective when comprised of native vegetation (Karr and Schlosser 1977).
- Restores more adaptable landscapes. Native plant species have adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance, are resistant to most pests and diseases, and require little or no irrigation or fertilizers once established. Therefore, maintaining native plant species in riparian areas can help to maintain water quality and improves riparian vegetation functions such as stormwater retention, groundwater recharge, etc.
- Favors insects of local food value for species of concern (for example, insects eaten by juvenile salmon).
- Prevents degradation of adjacent healthy riparian areas.

Credit 2.4: Invasive Plants

Points available

This credit offers up to 4 base points.

Invasive Species	Base points
Remove invasive vegetation and re-plant cleared areas with native vegetation over the entire property; continue to manage invasive species as part of regular landscape maintenance.	Property > 0.2 hectares (½ acre) – **4** points
	Property ≤ 0.2 hectares (½ acre) – **3** points
Remove invasive vegetation and re-plant cleared areas with native vegetation in the riparian buffer (area within 10m/35ft of OHWM).	**2**

How to proceed

Many of the resources below provide information on identifying invasive plants, techniques for their removal and the native species to use as replacement vegetation. Check your proposed project with local, state/provincial, or federal authorities before getting started.

You might also enlist the help of a local ecologist, botanist, landscape architect, horticulturist, or landscaper with experience in riparian planting for marine or freshwater shores, depending on where you are situated. Your municipal or county/regional district government may also be able to help with written information, expertise and even some funding for invasive removal. Similarly, many environmental organizations are involved with invasive management and native plant restoration; check with a local land trust or natural history society for ideas and help.

Include ongoing invasive species management as part of the regular landscape maintenance schedule or checklist (see Appendix H). Monitor your property for several years for signs of returning invasive vegetation and/or noxious weeds, and plan to remove them as needed. Remember that it is much easier to remove these species as they emerge rather than once they are established. Again, a qualified professional, your local government or local environmental group can advise on effective but environmentally friendly ways to manage particularly tenacious species. Consider having a long-term management plan drawn up by a qualified professional to improve the likelihood of successful invasives management. Suggest that your neighbours share in work parties to help each other or suggest the same to your Homeowners or Neighbourhood Association.

Monitoring

- Pre-construction:
    - Identify any invasive vegetation species present on the property. Please list the species name and estimate percent of the property area affected. Note obvious occurrences of invasives on adjacent properties that might be reasonably expected to spread, for example, knotweed thickets near property boundaries.
    - Take photographs.
- Post-construction:
    - Note method(s) of management and species removal.

- Estimate of total area re-planted with native plants.
- Take photographs from the same vantage point as before construction.

Submittals

1. Existing Conditions Plan (Prerequisite 1) with original extent of invasive vegetation.
2. Site Design Plan (Prerequisite 2) with locations where invasive species have been removed and replanted with native vegetation.
3. Photo documentation of original extent of invasive vegetation, and new native vegetation on site (before/after).

Credit 2.5: Organic Material

To qualify for this credit, retain existing or add organic material for enhanced habitat along shores where it naturally occurs.

This credit pertains to organic matter such as seaweed or woody material (often referred to as woody debris) that washes up and is naturally found on the surface of shorelines. Woody debris can be important in some regions and includes downed trees, stumps, branches, leaves and other tree-sourced materials that wash up onto or fall naturally on a beach or into the water.

Figure 2.5.1. Large woody debris. *Credit: H. Rueggeberg (left), South Puget Salmon Enhancement Group (right).*

In the marine environment, woody material that influences shore processes and shoreline features tends to be large and is often referred to as large woody debris (LWD). Marine shorelines often have other sources of organic material such as seaweed and wrack (washed up dead plants usually from tidal marshes and submerged aquatic vegetation). These deposited materials provide food and habitat for many species and can also help protect the shoreline from erosion by trapping sediment and providing nutrients for shoreline vegetation. Removing or harvesting wrack from shorelines has a negative impact including reducing valuable coastal habitat. On lake shores, woody debris tends to be of smaller dimensions, ranging from twigs to small logs and referred to as, small woody debris (SWD). LWD typically occurs above the high tide line, whereas due to the absence of tides and strong currents, SWD may be submerged or partially submerged.

Where this credit applies

This credit applies to all types of shores, with particular significance on sediment-based shorelines. Adding organic material to a shoreline must provide or enhance habitat value; **installing logs or root wads solely to retain sediment or attenuate waves does not qualify under this credit.**

Organic material includes detached seaweed, dead plants (wrack), trees, branches and stumps that have naturally washed up onto the beach or fallen into the water. For this credit, it includes organic material that occurs on the beach prior to construction and/or is added as part of the shoreline design for habitat purposes. It does not include organic material that is recruited by natural processes after the project has been completed. However, this recruited material should not be removed from the shoreline (see Shoreline Maintenance Checklist in Monitoring Guide).

Credit 2.5: Organic Material

Benefits

To the homeowner

Organic material can act to trap, anchor, and stabilize beach sediments and vegetation, providing natural shoreline protection. This is particularly valuable in marine environments and to a lesser extent in freshwater environments.

To the environment

Organic material is a vital component of healthy shoreline ecosystems in both marine and lake settings. It creates habitat cover and complexity and provides a source of organic matter and food for aquatic insects, invertebrates and the organisms that feed on them. Organic material helps to accrete and sort sediments, creating spawning habitat for forage fish. It stabilizes banks and shorelines, supports the growth of native shore grasses and sedges, and protects dune communities, thereby supporting the shoreline ecosystem.

Points available

This credit offers up to 4 base points plus up to 2 bonus points.

Organic material	Base points
Where organic material already occurs along a minimum of 50% of the length of the shoreline, **retain (or remove and replace) and maintain** a minimum 80% of that existing material. OR	**3**
Where organic material is diminished from natural conditions based on nearby reference shorelines (see How to proceed), **add** organic materials in a way that provides habitat value and is consistent with naturally occurring organic materials in the area.	**1** point per 10m (30ft) of length of shoreline occupied by added organic material to a maximum **3** points
For wrack material: Create and implement a shoreline maintenance plan that does not alter natural organic material on the shoreline (see Monitoring Guide for Shoreline Maintenance Checklist)	**1**
Bonus (available once one or more base conditions are met)	**Bonus Points**
Removal of a significant amount of refuse/garbage from the beach above and below the OHWM; e.g., 20kg/50lb. of metal, 60L/2ft^3 of Styrofoam/plastic or similar material. As much as possible, such material must be disposed of in appropriate recycling facilities.	**1**
Monitoring (Third year post-construction)	**1**

How to proceed

To apply for this credit, identify and map the distribution of existing organic material as part of the existing conditions plan in order to integrate it in the site design plan. In marine sites, LWD may be mapped on a per-piece basis. On lakes, it may be more feasible to show the zone or length of shoreline occupied by SWD; this also applies to marine shorelines where seaweed or plant wrack are commonly deposited surface materials.

Temporarily moving, saving, and re-installing natural organic material to facilitate a development project is allowed. Removing or relocating organic material may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/ provincial, or federal authorities before getting started.

Consult with a qualified professional such as a marine or freshwater biologist before introducing any material to determine the most effective placement from a habitat perspective and to avoid creating hazards to sensitive habitats or Species at Risk.

Figure 2.5.2. Large woody material added as part of a soft shore treatment. *Credit: H. Rueggeberg.*

On marine sites, base the addition of LWD or other organic materials on nearby reference shorelines when it comes to selecting material size, type, and location—particularly with respect to elevation on the shoreline. LWD can be placed on the beach or semi buried, particularly if it is placed as part of a nature-based project (see Credit 1.5: Nature-Based Erosion and Flood Management) or loosely on the upper and back beach areas, in wetlands, and along the shoreline of lakes. Stabilize LWD by mechanical means (anchors) only when recommended by a qualified professional and with approval by local authorities.

The *Marine Shoreline Design Guidelines* (Johannessen et al*.,* 2014) devotes an entire chapter to the use of LWD in shoreline protection and enhancement (see Further Reading to find this useful reference).

On lake shores, it is more difficult to try to replicate natural conditions due to the density at which organic materials often occur in nature; however, the addition of even a few logs or branches, particularly in conjunction with overhanging vegetation, can add significant habitat for fish and invertebrates. Consider dedicating a section of your shore as juvenile fish rearing habitat by planting emergent vegetation or adding clusters of branches along the high water mark.

Monitoring

- Pre-construction, post-construction and third year:
    - Photographs of organic material on the property. Please list the organic material type (i.e., LWD, SWD, wrack) and estimate percentage (%) of the shoreline covered.
- Post-construction:
    - Photographs of organic material retained or added. Note type of organic material(s) and estimate percentage (%) of shoreline covered by added or retained materials.

- Bonus monitoring: See Monitoring Guide for instructions.

Submittals

1. Site Design Plan (Prerequisite 2) showing pre-existing and retained organic materials.
2. Photo documentation (before/after) of pre-existing and retained organic material OR added organic material.

If applying for wrack material points:

3. Shoreline Maintenance Plan and completed Shoreline Maintenance Checklist (See Monitoring Guide).

If applying for bonus points:

4. Estimated weight/amount of removed refuse/garbage with photos.
5. Letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Credit 2.6: Overwater Structures

To qualify for this credit, do not install new overwater structures at a project site, and remove any existing overwater structures. If overwater structures are necessary, design them to be Green Shores friendly.

Overwater structures include piers, ramps, floats, covered moorage, boat work sheds, and mooring pilings. Boats stored in cradles below the Ordinary High Water Mark, Highest High Water Level or Natural Boundary (OHWM/HHWL/NB) are also considered overwater structures. An overwater structure may include multiple elements such as a pier, ramp, and float.

Figure 2.6.1 Overwater structures. *Credit: H. Rueggeberg.*

Overwater and in-water structures can alter physical and biological processes that are critical to fish and aquatic life. In particular, light reduction or shading reduces the survival of aquatic plants that provide food and habitat for fish. Structures can also physically block migration and produce light/dark contrasts that affect fish and bird movement, e.g., fish respond by moving into deeper water which increases the risk of predation.[9]

Where this credit applies

This credit applies to all types of shores, and to the construction, renovation, or removal of overwater structures (OS); however, constructing a new overwater structure is eligible for this credit *only* if:

[9] Washington State Legislature WAC 220-660-140: Residential and public recreational docks, piers, ramps, floats, watercraft lifts, and buoys in freshwater areas. http://app.leg.wa.gov/WAC/default.aspx?cite=220-660-140.

a) it will be used for water dependent uses (e.g., boating needs and not living space); and

b) there is no publicly accessible dock or pier within 150m/500ft.

The 'no pre-existing OS and no new OS installed' category in this credit will apply only to sites where circumstances support the construction and operation of an overwater structure. If the site meets all the following criteria, an applicant can apply for points under this credit:

- Local regulations allow the construction of overwater structures in the area of interest;
- Appropriate regulatory approvals have been obtained, including demonstration that the dock design and construction does not impact sensitive or critical habitats; and
- The shoreline conditions make the construction and operation of an overwater structure feasible – i.e., the site is not subject to high wave exposure, strong currents, breaking waves and swell.

In the event of a disagreement between the applicant and the verifier, about if an OS is feasible based on the shoreline conditions, the applicant can have a wave and current analysis conducted by a Qualified Coastal Professional (see Glossary for definition) that confirms the following: [10]

- The site is not subject to high wave exposure (a sea state that exceeds 30cm/1ft wave height more than 2% of the time).
- The site is not subject to strong currents (currents that exceed 0.60m/sec or 2ft/sec, either seasonally in freshwater or tidally in marine water).
- The site is not subject to breaking waves or swell waves (waves with heights exceeding 0.15m/0.5ft at wave periods less than 1 minute).

Benefits

To the homeowner

Having no overwater structures, or having structures that are Green Shores designed, can result in several benefits:

- Cost savings: Green Shores-friendly structures (for example, grated construction) tend to be durable, and require little or no maintenance.
- Green Shore designs and construction methods are usually consistent with local regulations and codes, and therefore, the permitting process may be easier, shorter, and less costly (because, for example, detailed biological assessments and habitat mitigation may be avoided).
- Better natural aesthetics.

[10] Sources for specifications: Fisheries and Oceans Canada, Small Craft Harbour Accommodations Guidelines; American Society of Civil Engineers, Small Craft Harbour Guidelines.

- Less scary to swim under because there is more underwater ambient light beneath such structures.

To the environment

This credit:

- prevents the loss of nearshore ecological functions such as underwater natural ambient light and habitat area;
- minimizes the effects of overwater structures on underwater plant communities;
- minimize disruption of fish movement and migration;
- decreases potential predation on juvenile salmon by reducing exposure to predators.

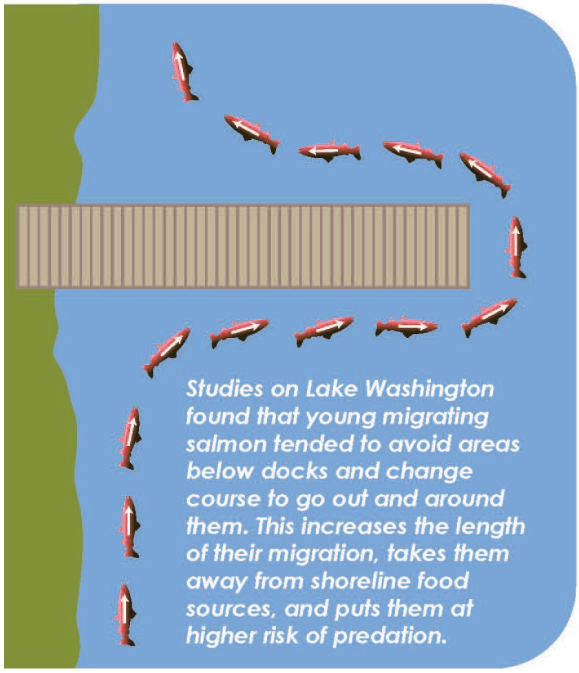


Figure 2.6.2 Young salmon migration around overwater structures *www.govlink.org/watersheds/8/action/greenshorelines/.*

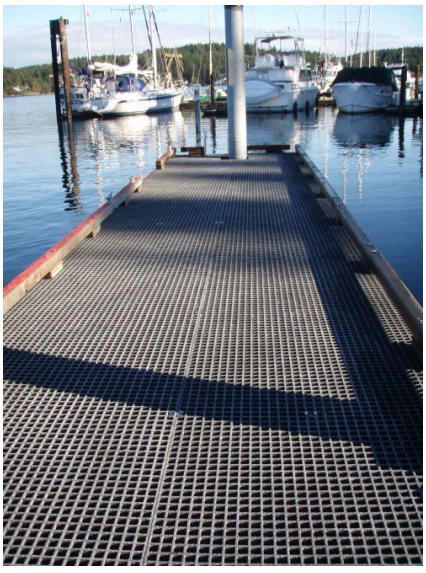
Points available

This credit offers up to 7 base points

Overwater structures		Base points
No OS: Existing overwater structures (OS) are removed, and no new replacement overwater structures are installed OR		**6**
No pre-existing OS and no new OS installed		**4**
Best Practices OS: If there is an existing overwater structure (OS) on your property, demonstrate that it is eligible for this credit (see "Where this credit applies" above) and meets the Best Practices outlined below (see "How to proceed"), or is being retrofitted as part of your project to meet the Best Practices outlined below (see "How to proceed").	Dock* ≤ 1.8m/6ft wide and ≤ 7.5m^2/80ft^2 in area, with at least 40% functional grating**	**1**
	Pier* < 1.8m/6ft wide with at least 50% functional grating OR Ramp* < 1.3m/4ft wide with 100% functional grating	**1**
	Additional grating coverage: - 80-100% functional grating of OS surfaces OR	**2**

	- 50%-79% functional grating of OS surfaces	**1**
	No lighting on OS, or diffuse lighting that is not directed downward to water or upward to sky	**1**
Shared OS: Share the use of an OS on your property or a neighbouring property	OS shared with one neighbour (one OS per two properties)	**1**
	OS shared with two or more neighbours (one OS per three or more properties)	**2**

*Dock – a structure that is fixed to the shoreline and floating on the water
*Pier – a fixed, piling-supported structure
*Ramp – a structure that connects a pier or shoreline to a dock or float
**Functional grating - grating with an open area of at least 60%. If grating covers more than the minimum % deck surface area specified above, the grating's open area may be reduced to a minimum 40%.



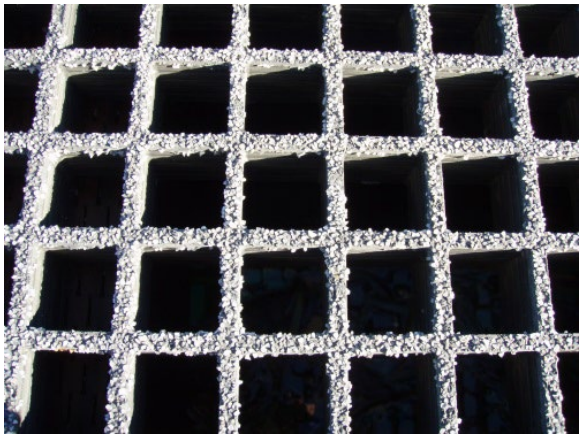


Figure 2.6.3. Pier grating. *Credit: H. Rueggeberg.*

How to proceed

Not having an overwater structure is the simplest way to achieve points under this credit. Applicants are encouraged to use mooring buoys if boat moorage is needed, use a public dock if one is nearby, or share an existing dock with neighbours. Note that San Juan County in Washington State requires anyone seeking to build a dock to first attempt to create and sign a "Joint Use Agreement" with neighbours. Check with your local regulatory authority before installing any OS or mooring buoy.

Where an overwater structure is required, adhere to the following **Best Practices** in the design, construction, maintenance, and renovation of overwater structures:

- Assess the nearshore and benthic habitat before starting to plan, so that the structure is located where no critical/sensitive habitat exists.
- Provide light penetration by using functional grating (grating with at least 60% open area) on all overwater structure surfaces.
- Minimize the size of overwater structures to only what is needed to serve the purpose and avoid impacting riparian, emergent or submerged vegetation.
- Floating components should not rest on the bottom substrate at any time. Also avoid using floating docks where eelgrass is present as these structures are closer to the bottom than pier docks and result in larger shadowed areas.
- For piers and ramps, minimize disturbance of the bottom by using the minimum number and size/diameter of pilings required to achieve safety and stability. Also use materials that reflect light to the underwater environment such as concrete.
- Avoid adding covered moorages, houseboats, and boathouses as these structures also create shadowed areas on the water surface.
- Use nontoxic materials for piles and other support elements (see Credit 3.4 Creosote Materials Removal for points).
- Minimize shading by orienting a structure in a north-south direction and positioning it a minimum of 2.1m/7ft above benthic vegetation.
- Minimize overwater lighting and ensure that any lighting is not directed into the water, so as to not attract or confuse fish.
- Design structures to be retractable or removable when not in use (i.e., during the winter season).

On both marine and freshwater shorelines, ensure that your OS meets all local and provincial/state requirements.

Monitoring

- Pre-construction and post-construction
    - Photographs of shoreline showing absence or presence of OS and, if present, the condition of the OS.

      Photographs confirming the presence/absence/removal of the overwater structures and showing the conditions of the site and OS after construction.

Submittals

1. Existing Conditions Plan (Prerequisite 1) with any existing OS.
2. Site Design Plan (Prerequisite 2) showing (as applicable):
    a. Footprint of OS removed.
    b. Footprint of new, retained, or retrofitted OS.
    c. Plan or report showing OS meets eligibility criteria for Credit 2.6 and conforms to best practices (see above).

3. Lot plan showing properties that share a common OS and the location of shared structure.
4. Photo documentation of shared OS or before and after removal, construction, or retrofitting.

Credit 2.7: Access Design

To qualify for this credit, design, or re-design access to the shoreline from upland areas so that it avoids or minimizes environmental impacts on the shoreline area.

Figure 2.7.1. Access design. *Credit: N. Faghin.*

Shoreline owners typically want to get to the water's edge, whether by a foot path, stairs, a driveway, or a ramp for boat access. Numerous accesses can have negative effects on shoreline environments by trampling and removing riparian vegetation (favoring the colonization by invasive species), hardening the upland-shoreline interface and damaging backshore, foreshore, and intertidal habitats.

Where this credit applies

This credit applies to any development project, particularly in the riparian area, on any type of shore, and in both marine and lake environments. The access being applied for must meet any applicable local codes with respect to safety, aesthetic, and/or environmental impact. For example, if the access involves stairs, landings, or decks there may be local laws regarding height above ground, handrail requirements, foot guards, etc.

Benefits

To the homeowner

Controlled access usually means lower construction and maintenance costs and enhances the aesthetics and value of the property.

Credit 2.7: Access Design

To the environment

Avoiding or minimizing the extent of accesses reduces permanent loss of riparian and foreshore habitats. Smaller accesses also may translate to lower levels of human activity, thereby causing fewer disturbances to wildlife using the shoreline.

Points available

This credit offers up to 3 base points

Access design	Base points
Remove an existing shoreline access and replace it with native vegetation, or do not have/build any access to the shore on your property. OR	**3**
Have an existing access that meets 'Best Practices' (outlined below under How to proceed), or replace an existing access with one that meet's 'Best Practices', or if there is no pre-existing access, build a new access that conforms to the 'Best Practices' OR	**1**
Share your access that meets 'Best Practices' with one or more neighbours such that there is only one access per two or more properties.	**2**

How to proceed

First ask "do I really need my own access to the shore? Is there a public access nearby that I can use, or could I share an existing access with one or more neighbours?"

If the answer is "no, I don't need my own access" you have just earned full points, saved the shoreline environment one more impact, and saved construction, approval, and maintenance costs and time.

If the answer is "yes," **follow these 'best practices' for access design**:

- Ensure your access meets all local, state/provincial, or federal regulatory requirements are adhered to with respect to structures used to access the shoreline, including permit applications, setbacks, safety, design and/or environmental design considerations, etc.
- Assess the shoreline and backshore to determine the best place for getting to the water based on steepness, ground stability, soil softness, vegetation, drainage, environmental sensitivity, and habitat value. A rocky site is usually hardier than sites with soft sediments. Choose sites that have been previously impacted since they have lower habitat value than an undisturbed site. Do your utmost to protect undisturbed areas.
- Provide for all needs in one access rather than multiple accesses.
- The access should be no wider than 1.5m/4ft.
- Size and align paths and stairways to address terrain (flat versus steep), to protect existing vegetation (particularly major trees, shrubs, and rare plant groupings) and avoid hazardous areas such as ravines, bluffs, cliffs, and embankments.

- Use permeable, non-toxic materials for the access surface. For lightly used paths, native soils may be adequate. For heavier use or where drainage is an issue, crushed aggregate (gravel) with a lightly compacted aggregate sub-base is preferred. Bark mulch and hog fuel are not recommended as trail surfaces because they produce leachates that can cause water quality problems. Asphalt and concrete are also not recommended as they leach contaminants in the short term and are impermeable and accelerate run-off. If solid surfaces are necessary, install pervious pavers.
- Use raised walkways where required to avoid crushing ground cover.

Monitoring

- Pre-construction and post-construction
    - Photo documentation of shoreline showing absence or presence of access areas.
    - Photo documentation, from the same vantage points as in the initial survey, confirming the presence/absence/removal of access areas and showing the conditions of the site and access areas after construction.

Submittals

1. Existing Site Conditions plan (Prerequisite 1) show all shoreline accesses (paths, stairs, etc.)
2. Site Design Plan (Prerequisite 2) with (as applicable):
    a. Replacement of access(es) with native vegetation.
    b. Explanation of how new or retrofitted access(es) meet best practices (see above).
    c. Location of access and number of properties sharing the access.
3. Photo documentation (before/after) showing access removal, addition or retrofit.

Category 2: Further Reading

Category 2: Shoreline Habitats

General

Harris, C.W. and Dines, N.T. (1997). *Time Saver Standards for Landscape Architecture 2nd Edition* [provides additional information on planting density calculations, typical plant sizes, etc.]

Canadian Society of Landscape Architects (CSLA) and the Canadian Nursery & Landscape Association (CNLA). (2020). *The Canadian Landscape Standard Second Edition.* [Canadian standards reference that has a section on planting and nursery stock quality standards]

Santiago, M.J. and Rodewald, A.D. (2004). *Dead Trees as Resources for Forest Wildlife*. Ohio State University. [Factsheet W-18-04]
https://woodlandstewards.osu.edu/sites/woodlands/files/imce/0018.pdf

National Audubon Society. (n.d.) Lights out: Providing safe passage for nocturnal migrants.
https://www.audubon.org/lights-out-program

Portland Audubon. (2020). Bird friendly lighting. https://audubonportland.org/wp-content/uploads/2020/10/Bird-Friendly_lighting_flyer_2020.pdf

Canadian Parks and Wilderness Society Newfoundland and Labrador (CPAWSNL). (n.d.) Puffin and Petrel Patrol. https://cpawsnl.org/puffinpetrelpatrol/

Canada

Fisheries and Oceans Canada. (2022). *Critical Habitat of Species at Risk*. [Aquatic Species data]
https://open.canada.ca/data/en/dataset/db177a8c-5d7d-49eb-8290-31e6a45d786c

Government of Canada. (2018). Nesting Periods. [migratory birds]
https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html

Watersheds Canada. The Natural Edge. (2022). Plant Database. [native plants]
https://naturaledge.watersheds.ca/plant-database/

USA/Washington

Washington Department of Fish and Wildlife. (2022). *Priority Habitats and Species (PHS).*
https://wdfw.wa.gov/species-habitats/at-risk/phs

Visit the Green Shores website for more region-specific resources.

Category 3: Water Quality

The Water Quality category encompasses actions that a shoreline landowner can take to reduce or eliminate the amount of sediment, chemical and organic pollutants that are discharged to lakes and marine waters directly or in surface runoff.

The runoff associated with rain events is typically referred to as stormwater, but it is important to recognize that the majority of surface runoff is from light, steady rainfall, and not just occasional storms. Therefore, in this credit, we use the term rainwater management in addition to stormwater to refer to the runoff from regular rainfalls as well as bigger storms.

In this section:

Credit 3.1: Site Disturbance

To qualify for this credit, minimize the amount of clearing, grading and soil disturbance during construction on a whole-site development.

Figure 3.1.1. Minimizing disturbance. *Credit: Sustainable Building Construction sustainablebuildingconstruction.blogspot.ca/2011_08_01_archive.html.*

Where this credit applies

This credit applies to whole site development only. It is particularly important for projects on sloping sites, sites with runoff from upland areas, sites with highly erodible materials, and bluff properties where slope failure risk is high.

Benefits

To the homeowner

Minimizing site disturbance benefits homeowners by:

- Reducing the risk of soil erosion and the cost of erosion control measures during and after construction;
- Retaining valuable topsoil, which means less cost to buy and truck in expensive topsoil to rebuild landscapes;
- Reducing future landscape installation costs;

- Reducing irrigation costs; existing native vegetation is often better suited to site conditions and typically does not require additional irrigation;
- Maintaining the intrinsic value of native trees and shrubs;
- Maintaining shade and wind breaks that can save on cooling and heating costs.

To the environment

Numerous studies have shown vegetation removal and run-off from upland areas to be the primary cause of degraded water quality, increased near-shore water temperatures and sedimentation, and smothering of nearshore flora and fauna. Minimizing disturbance of soil and vegetation prevents construction-related pollutants, particularly sediment, from reaching local fresh and marine waters.

Minimizing soil disturbance and compaction also:

- Helps to retain soil structure and pore space that allows movement of water and air; healthy native soil with good structure supports riparian vegetation and generally helps to reduce surface water runoff;
- Retains beneficial biological components: worms, micro-organisms, and roots in existing soils;
- Avoids trucking of stripped material off site or bringing soil onsite, lowering costs and reducing greenhouse gas emissions;
- Avoids the release of greenhouse gases from organic soils when they are disturbed.

Points available

This credit offers up to 3 base points for projects involving the whole property/lot.

Minimize site disturbance for previously developed site:	Base points
For projects involving the whole property/lot, limit development to previously developed portions of the lot, and protect remaining native soils and vegetation from disturbance over:	
• ≥60% of the site area*	**3**
• 45-59% of the site area	**2**
• 20-44% of the site area	**1**

How to proceed

Minimize site disturbance during planning, design, and construction phases of a project by doing the following:

- Ensure all local, state/provincial, and federal regulatory requirements are adhered to regarding construction in and around riparian zones.
- Locate buildings and hardscape surfaces on previously impacted areas of the site such as clearings, existing building footprints, or on areas that were going to be cleared anyway (e.g., to remove invasive species such as Himalayan blackberry).

Credit 3.1: Site Disturbance

- Minimize the amount of excavation and earthworks needed by fitting the building or landscape design to the site topography rather than flattening the site to fit the building or landscape.
- During construction, protect vegetation and native soil areas from disturbance and compaction by surrounding them with a secure 1.2m/4ft fence of high visibility material.
- Restrict construction vehicle traffic to designated driveways/accesses to reduce damage to soils and vegetation. On small sites, this may mean parking offsite on a nearby road edge. Encourage carpooling or alternative modes of transport to and from site.
- Designate specific staging areas for materials (gravel, lumber, etc.) in previously disturbed areas or within new building footprint.

To attain this credit:

1. Determine your lot area as defined by a property survey. The Natural Boundary, Highest High Water Large Tide (HHWLT) or OHWM (i.e., the property line along the waterfront) must be clearly delineated on the survey plan (See Submittals).
2. Measure the portion of the site area where soil will be disturbed and vegetation removed to make way for the project.
3. Calculate the percent of the site that will remain undisturbed and use that percentage to determine applicable points based on the table above.

Monitoring

Since this credit applies only to the construction phase of a project, three-year monitoring bonus points are not available.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing location of project. Ensure that the Natural Boundary, HHWLT or OHWM (i.e., the property line along the waterfront) is clearly delineated.
2. Site Design Plan (Prerequisite 2) with area of disturbance delineated and measures taken to minimize disturbance in design, construction and post-construction phases.
3. Photo documentation (before/during/after) showing measures taken to minimize disturbance.

Credit 3.2: Reduce and Treat Runoff

To qualify for this credit, minimize the amount of impervious surface area and use stormwater source control measures to reduce the quantity and improve the quality of surface runoff.

Figure 3.2.1 Rain garden. *Credit: ShorelineAreaNews.com.*

The runoff associated with rain events is typically referred to as, stormwater or rainwater runoff. In this section, the terms "rainwater management" and "stormwater management" are assumed to be synonymous.

Low impact development (LID) is an approach to site development and rainwater management that aims to mitigate the impacts of surface runoff to water bodies by reducing the amount of impervious surface area and thereby reducing the quantity of surface runoff. In contrast, Stormwater **BMPs** are strategies and installations designed to treat the runoff generated by any impervious areas that do occur. LID and BMPs can be combined or used independently to reduce the impact of development on drainage systems. Please refer to the Further Reading section at the bottom of this credit for reference materials on LID strategies and BMPs.

Impervious surface area (ISA) is the area of a given lot or property that is covered by man-made surfaces that do not allow water to transmit or filter through them. ISA includes rooftops, roads, sidewalks, driveways, and parking lots that are covered by impenetrable materials such as shingles, asphalt, concrete, plastic, brick, and stone. The ISA for a project is often referred to as the "built footprint." ISA can be reduced by the application of LID strategies.

Effective impervious area (EIA) is the impervious surface area on a site that drains into a conveyance system (ditch or pipe) without any treatment to reduce flows or improve water quality. The objective of

stormwater BMPs is to reduce EIA as much as possible. To reduce EIA, runoff can be directed to BMP features such as absorbent landscaping (characterized by deeper, organic soils), rain gardens, green roofs, and permeable paving. The ultimate goal is to avoid using only pipes, culverts, and ditches that quickly move rainwater offsite, and instead use naturalized drainage systems that slow, absorb, and filter water through vegetation and soil—just as forests, wetlands, grasslands, and other natural ecosystems do.

Where this credit applies

This credit applies to any development that alters the amount of impervious surface on a site. This credit is particularly important for sloping sites, sites with runoff from upland areas, sites with highly erodible materials, bluff sites where slope failure risk is high, and sites that are adjacent or connected to water bodies that receive rainwater runoff.

Benefits

Figure 3.2.2. Pervious pavers. *Credit: belgardhardscapes.files.wordpress.com.*

To the homeowner

Impervious surfaces (roofs, driveways, patios, walkways, etc.) generate runoff from all but the smallest rain events. Runoff is concentrated from these surfaces and discharged to storm drain systems and/or to nearby water bodies. These concentrated water flows can cause erosion and property damage, increasing maintenance and repair costs. On waterfront properties, particularly low and high bank sediment shorelines, increased surface runoff can significantly increase the rate of shoreline erosion.

Managing rainwater runoff on-site can reap other benefits for homeowners. For example:

- Reducing ISA (applying LID strategies) can save money by reducing the amount of pavement, concrete and other surface materials required, while providing more opportunities for green space on your property; not mowing areas adjacent to the shoreline saves money and reduces the risk of erosion.
- Less runoff production means less demand on local stormwater infrastructure, resulting in less wear and tear on existing pipes, less maintenance for culverts and ditches, and fewer costs for new infrastructure.
- If onsite rainwater management measures are designed properly, property owners may be able to avoid requirements to connect to local storm drain infrastructure, which can save money. In fact, some local jurisdictions provide incentives for managing runoff on-site rather than using the storm drain system.
- Areas that would traditionally be landscaped can be designed as rain gardens or absorbent landscape with little additional cost, and properly designed permeable paving is a cost effective means to manage runoff in driveways and patios. Both measures provide attractive qualities that can add to property value.

Credit 3.2: Reduce and Treat Runoff

To the environment

Minimizing rainwater runoff and encouraging infiltration into soil benefits both aquatic and terrestrial environments. Runoff concentrated from roads, driveways, parking areas, and rooftops picks up heavy metals, oil, chemical pollutants, particulates, and sediment that damage water quality. Minimizing the amount of runoff and infiltrating the runoff that does occur through plants and soil filters out pollutants and helps to recharge groundwater. Reducing ISA also helps maintain existing water flow paths that are critical to recharging groundwater, streams, and other receiving waters.

Figure 3.2.3. Pervious parking area. *Credit: H. Rueggeberg.*

Rain gardens, absorbent landscapes, and green roofs function to intercept rainfall. The plants in these green rainwater management facilities return rainwater to the atmosphere through transpiration or infiltrate it into the soil. Absorbent landscapes can hold more than 20% of their volume in water and will filter efficiently. Rain gardens, absorbent landscapes, and green roofs also provide a diversity of habitats for birds, insects, and wildlife—even in urbanized areas.

Points available

This credit offers up to 6 base points plus up to 3 bonus points

Reduce and treat runoff from impervious surfaces	**Lot area**			**Base points**
	< ¼ acre (<1000m²)	**¼ - ½ acre (1000-2000m²)**	**> ½ acre (>2000m²)**	
Impervious Surface Area (ISA)* as % of lot area	< 25%	< 15%	---	**3**
	25-35%	15-30%	10-15%	**2**
	36-45%	31-40%	16-25%	**1**
Effective Impervious Area (EIA)** as % of lot area	< 10%	< 5%	---	**3**
	10-20%	5-10%	< 5%	**2**
	>20-25%	>10-15%	5-10%	**1**
Bonus (available once any of the above conditions have been met)				**Bonus points**
Detain at least 1900L/500 US gallons of rainwater				**1**
Use detained rainwater for household and/or landscape use				**1**
Monitoring (3 years post-construction)				**1**

Credit 3.2: Reduce and Treat Runoff

*ISA includes all artificial hard surfaces, including those that use LID measures to reduce and/or treat runoff. The smaller the total ISA, the more points are available.

EIA is the ISA minus the area of surfaces that are treated with some LID measure such as a green roof, rain garden, permeable pavement or pavers, or absorbent landscape that receives drainage from a roof, deck, or other impervious surface. Use the EIA Calculation Table later in this section to determine the EIA on your site. **If no ISA is treated, EIA = ISA.

How to proceed

Right from the start, incorporate LID techniques and BMPs in the project design to reduce the ISA and EIA. Problems often arise when building and site design plans are completed only to discover that there is not enough room left on the site to manage rainwater. Remember, the smaller the total impervious area, the less expensive managing and treating runoff will be.

Techniques that you can use to minimize the ISA and EIA include:

- Design smaller buildings, build up rather than out (within local ordinance or bylaw requirements), and cluster buildings so that walls, services, and construction space are shared.
- Minimize driveway length and width or share a driveway with neighbouring properties. Reduce parking area where feasible.
- Maximize the areas of vegetation and absorbent landscapes. Create a rain garden to receive runoff from roofs, patios, and/or driveways.
- Convert areas of existing or planned impervious paving to permeable paving products, ensuring their proper installation.
- Install a green roof wherever practical and suitable.

Discharge of runoff must be designed to adapt to site conditions, particularly where slope stability is an issue. Infiltrating runoff to ground near the top of bluffs and steep slopes may decrease the stability bluffs and should be carefully considered by a qualified professional.

To achieve points for low ISA%:

1. Determine the size of the lot based on a property survey or scaled site plan.
2. Measure the ISA including existing and/or proposed roof areas, driveways, parking areas, patios, and paths.
3. Calculate the percent of the site that is covered by existing and/or proposed ISA.
4. From the Points Available table, determine points based on lot size and percent ISA calculation.

Figure 3.2.4. A green roof. *Credit: J. Lundholm.*

Credit 3.2: Reduce and Treat Runoff

To achieve points for EIA%:

1. On the design plan, delineate all existing and proposed impervious areas and show how water is drained from these surfaces, indicating the water flow path. If installing one or more BMP features (rainwater management facilities), indicate what they are and where they are located on the design plan. Calculate the area of the ISAs that are draining to the corresponding BMP facility and enter this area in the applicable Treated Area section in the EIA Calculation Table below. Lastly, show emergency overflow paths from BMPs to receiving environment or storm drainage system.

EIA Calculation Table

	Insert m^2 or ft^2	Comment
Lot area		From existing conditions or design plan (lot survey)
Impervious surface area (ISA)		ALL hard artificial surface areas
Treated area*		
a) Green roof		An engineered roof that is partially or completely covered with vegetation and a growing medium (enhanced soil) over a waterproof membrane; may also include additional layers such as a root barrier and drainage and irrigation systems.
b) Rain garden		A concave landscape area with deep soils covered with plants that can withstand periodic inundation but that drains relatively quickly through infiltration. The rain garden receives drainage from a roof, downspout, or other adjacent impervious surface. Permeable soil in the rain garden (and if necessary, a perforated drain below the soil to remove excess water) filters and cools water prior to releasing to the receiving environment.
c) Pervious paving		A surface layer that allows rainfall to percolate into an underlying base where rainfall is either infiltrated to underlying soils (if they are porous enough) or removed by a subsurface drain. The surface component can be porous asphalt or porous concrete; concrete or plastic grid structures filled with gravel or vegetated soil; or concrete modular pavers with gapped joints that allow water to percolate through. Note that pervious paving requires a properly designed underlying base adapted to site conditions.
d) Absorbent landscape		Area with enhanced soils (at least 30cm/12” depth and at least 10% organic content) that receives drainage from a roof, downspout or other adjacent impervious surface. Area must be designed to prevent surface erosion from a drainage point-source such as a downspout.
e) Naturalization		Areas left with natural vegetation or stop mowing lawn areas previously maintained by mowing

Other (state method)		
Total treated area		**= sum of above treated areas (in a), b), c), or d) categories) + 50% x treated area (e) category)**
Effective impervious area (%)		**= (ISA - Total Treated Area)/Lot Area x 100%**

* This is the area of impervious surface treated by the Stormwater BMP feature, not the area of the feature itself (though for green roofs, the area treated, and area of green roof area are the same).

2. Working with a professional, such as a qualified stormwater professional, or using stormwater design guidelines provided by local government, calculate the size of suitably designed rainwater management facilities needed to manage each ISA and indicate this on the design plan. A sufficient amount of land needs to be available to manage the runoff from each impervious area.
3. Use the EIA Calculation Table on the next page to calculate the Total Treated Area and the EIA% for the site.

   From the Points Available table above, assess points based on your lot size percent EIA. Consider reducing development footprint through the application of LID and/or adding BMPs to increase point score.

   Note that achieving a low EIA does not change your ISA – the latter remains constant with a given design.

Monitoring

- Pre-construction, post-construction and third year:
  - Provide photographs from the same vantage points showing:
    - Impervious Surface Areas (ISAs), and
    - Effective Impervious Surface Areas (EIAs).
    - If applicable, features to treat rainwater (including rain garden, pervious surfaces, green roof etc.).
- Bonus Monitoring: See Monitoring Guide for instructions.

Submittals

Project proponents must complete the following to qualify for this credit:

1. Existing Conditions Plan (Prerequisite 1) with impervious surface areas delineated.
2. For low ISA, Site Design Plan (Prerequisite 2) with:
   a. Description of measures taken to minimize impervious surfaces.
   b. Calculation of percentage (%) of the lot area covered by impervious surfaces.
   c. Photos of measures to reduce impervious area.
3. For EIA, Site Design showing:
   a. Flow paths and where surface water drains to.

b. Features to treat rainwater.
c. EIA calculation table (How to Proceed section above).
d. Photos of measures to treat runoff.

If applying for bonus points:

4. Site Design Plan showing structures used to detain at least 1900L/500 US gallons of rainwater and photos.
5. Photos and description of how detained rainwater is used for household and/or landscape use.
6. Letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Credit 3.3: Environmentally Friendly Building Products

To qualify for this credit, avoid using toxic chemicals or chemically treated wood in the construction and maintenance of overwater structures, or landscaping structures in shoreline areas.

Where this credit applies

This credit applies to whole site and shoreline/riparian development in marine and lake environments. It applies particularly to any projects that may involve the use of treated wood in overwater structures (docks, piers, etc.) and landscaping in the riparian buffer.

Benefits

To the homeowner

Using naturally preserved wood products (e.g., cedar, redwood, hemlock) and green alternative materials (e.g., glass wood, recycled plastic wood) has several benefits to homeowners. There is no exposure to chemicals and absorption from skin contact when using alternative materials. Plastic wood is coloured throughout and therefore does not require routine staining, which reduces maintenance costs. Similarly, allowing cedar and redwood products to age naturally reduces ongoing maintenance.

Figure 3.3.1. Treated wood BMP logo. *Credit: Western Wood Preservers Institute.*

To the environment

Avoiding the application of stains and paints and using untreated lumber for overwater structures and in riparian areas reduces the risk of chemical contamination to local aquatic ecosystems. Treatment chemicals can leach from wood when in contact with water and harm aquatic organisms. For example, dissolved copper has been shown to decrease the performance of salmon's sense organs, particularly olfactory (smell) function, which can impact juvenile salmon's ability to avoid larger, predatory fish. Treated wood can also create hazards during combustion or where loose wood dust particles or other fine toxic residues are produced.

Credit 3.3: Environmentally Friendly Building Products

Points available

This credit offers up to 4 base points

Environmentally friendly building products	Base points
Use untreated building materials for posts and pilings in docks and piers	**1**
Use untreated materials for other structural elements (beams, struts, etc.) in docks and piers	**1**
Use untreated materials for wharf and pier decking surfaces and landscaping elements that are in the riparian buffer	**1**
Do not use paints or stains on overwater structures - leave surfaces to weather naturally	**1**

How to proceed

To achieve this credit:

- Use natural rather than treated wood products whenever possible.
- If treated wood has to be used, look for the treated wood BMP logo (see previous page) or a certificate of compliance issued and signed by an independent treated-wood inspection agency.[11] Do all cutting in an upland area well away from any drainages, to reduce the risk of the saw dust entering the aquatic ecosystem.
- Use decking materials that will not require toxic finishes and cleaning agents; no matter how careful you are in their application; some will end up in the water. Metal, fiberglass, or plastic grating, recycled plastic lumber, and naturally rot-resistant wood can help avoid these problems.
- If you have or install wood decking, let it age rather than paint or stain it, as these materials flake off and can harm aquatic organisms. Use colour impregnated plastic wood where decking colour is desired.

Wood such as western red cedar and redwood have natural properties that help them resist rot. New technologies have also been used to reduce the ability of wood to absorb water, thereby reducing its rate of decomposition. These include coating wood in glass fibers (glass wood) and treating wood with acetic acid to create a water barrier. Alternative products to wood such as pre-cast concrete or aluminum that do not leach chemicals can also be considered. All of these products can be used for structural elements. Plastic wood (made from recycled plastic) can be used for decking and cladding (it is not suitable for use as a structural element). Recycled plastic wood is commercially available in a variety of colours that does not require staining.

Note that in freshwater in Washington State, under the Washington Administrative Code (WAC) 220-660-140:

- Treated wood should not be used for the decking of overwater structures.

[11] See the BMP guide published by the Western Wood Preservers Institute (listed under Further Reading) to learn more about certified treated wood.

- Treated wood may be used for structural elements, but any elements subject to abrasion by vessels, floats, etc. must incorporate design features that minimize abrasion of the wood.
- Use of creosote or pentachlorophenol pilings is prohibited; new and replacement pilings can be steel, concrete, recycled plastic, untreated wood or WDFW-approved treated wood.

Similar regulations may apply to marine and freshwater environments in other jurisdictions; check with local government agencies before proceeding with your project.

Common wood preservatives:

Creosote		Banned as a consumer preservative; very limited commercial applications.
Penta	Pentachlorophenol	Banned as a consumer herbicide; very limited commercial applications; not to be used for fresh or saltwater immersion.
CCA	Chromated copper arsenate	Banned for residential use due to arsenic content; limited commercial use.
ACZA	Ammoniacal copper zinc arsenate	Penetrates Douglas fir better than other preservatives.
ACQ	Alkaline copper quaternary	Water-based; considered a greener alternative to CCA.

Monitoring

- Post-construction.

Submittals

1. Site Design Plan showing location of new, renovated or maintained shoreline or riparian structures that use environmentally friendly products.
2. List of and receipts for all untreated materials used in construction of shoreline structures.
3. Photos of structures made with untreated materials.

Credit 3.4: Creosote Materials Removal

To qualify for this credit, remove and dispose of creosote-treated materials (pilings, retaining structures, beach debris).

Figure 3.4.1. Removing creosote material. *Credit: Washington State Department of Natural Resources.*

Where this credit applies

This credit applies to any site with functional or derelict creosote-treated pilings, as well as sites with significant amounts of creosoted beach debris.

Benefits

To the homeowner

Treatment of wood with creosote was a common method of wood preservation in the past; however, creosote contains many toxic chemicals that have the potential to impact human health. Creosote is composed of polycyclic aromatic hydrocarbons (PAHs), chemical compounds that are known or suspected to be carcinogenic and cause birth defects. Removal of creosoted wood reduces the risk of exposure, reduces odours and the production of “tar balls” on the shoreline.

Credit 3.4: Creosote Materials Removal

To the environment

Creosote is also toxic to marine and freshwater organisms. Removal of creosote from aquatic environments has been identified in Canada and the United States as a high-priority issue. Particular focus has been given to removal of derelict pilings—one of the primary sources of debris found on beaches and human exposure to creosote.

Overall, the removal of creosoted materials:

- Restores and improves habitat quality.
- Reduces the risk of bio-accumulation of PAHs in the food chain.
- Increases the survival rate of species living in close proximity to pilings, especially of larval forms of some aquatic species.
- Reduces contaminants in sediments and suspended in the water column.

Points available

This credit offers up to 6 base points.

Creosote Materials Removal	Base points
Removal of one standing creosoted piling OR Removal of a minimum 180kg/400lb of loose creosoted material	**2**
Removal of every additional standing creosoted piling OR every additional 90kg/200lb of creosoted materials	**1** point up to a maximum of **4** points

How to proceed

Achieving this credit requires identifying whether you have any creosoted material on your property or adjacent beach, whether it can be safely removed and where it can be safely disposed. Removing and disposing of creosote materials may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial, or federal authorities before getting started.

Steps to take include:

1. Survey your beach and property to identify any creosote-treated wood, beach debris, or remnants from piling projects.
2. Assess the condition of the creosoted material: is it readily accessible, or is it buried in sand or gravel such that extensive digging may be necessary? How much is there, and will it need machinery to be removed?
3. If there is a large amount and/or heavy equipment is needed to remove it, contact your local government or local environmental authority; they may be able to tell you the best way of removing it, or have a removal program themselves. You may need a permit to work on the beach.
4. Take care to control erosion and sediment migration while removing buried creosote debris or remnants of piling projects.

5. Determine disposal options. Creosoted material is considered hazardous waste in both Canada and the United States and must be disposed at a hazardous waste facility. Your local government or environmental authority can tell you where to take this material, or alternatively, where it can be safely used.

Monitoring

Not applicable.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing location and nature of creosoted materials.
2. Site Design Plan showing location and nature of creosoted materials removed. Note method of removal and disposal.
3. Receipt from approved disposal facility showing weight of material disposed.
4. Photos before, during, and after creosote removal.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

To qualify for this credit, do not use synthetic/inorganic herbicides, pesticides, or fertilizers in routine landscape maintenance.

Figure 3.5.1. Beneficial insects. *Credit: Washington State University (http://pep.wsu.edu/pestsense).*

For the purposes of this document, “cosmetic use” is defined as used for non-essential purposes; i.e., purely aesthetic function.

Where this credit applies

This credit applies to any type of project that involves landscape establishment and maintenance, particularly in riparian areas.

Benefits

Using a natural landscape maintenance approach improves the longevity and health of plants, reduces the risk of chemical contamination of marine and freshwater ecosystems, and reduces the number of chemical products at home that can come in contact with people.

To the homeowner

Pesticide exposure has been linked to several types of cancer, as well as hormone disruption. Young children are at greater risk due to their undeveloped immune systems, more permeable skin, and behaviours (i.e., playing on lawns and putting objects in their mouths). Avoiding the use of synthetic products reduces the risk of contact with chemicals that may be hazardous to health and wellbeing.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

To the environment

Pesticide and herbicide use contributes to the cumulative chemical impact on the natural environment. Spray application often results in non-targeted plants, insects, and aquatic organisms being exposed to harmful chemicals. Once released into the environment, these chemicals are washed into receiving waters and impact aquatic organisms and get into the food chain. Using natural products and biological control methods avoids these chemicals being released into the environment.

Synthetic fertilizers are produced from petroleum products (nitrogen content) or mined from the ground (phosphate and potassium content). Both sources of material have negative effects on the environment in terms of greenhouse gas production and impacts to mined landscapes.

Commercially available fertilizers are often quickly released when wet and therefore, can easily end up in runoff that is discharged to aquatic habitats. Excessive nutrients in aquatic ecosystems result in significant algal blooms or other ecological disturbances. Algal blooms foul beaches and result in fish kills. The excessive use of synthetic fertilizer also leads to the sterilization of soil microflora and reduces the availability of natural and trace minerals in the soil that are essential for plant health.

Irrigation Note: Excessive irrigation of landscape areas can result in nutrient and pollution transport to receiving waters and in some cases, cause erosion of sensitive bluffs by increasing groundwater seepage. Avoid irrigation on landscapes that drain towards bluffs and steep slopes. When in doubt, contact your local planning department to ensure that you are complying with local waterfront, slope, or hazard land codes or guidelines.

In addition, nitrogen inputs to local waters contributes to localized ocean acidification. Excess nitrogen fuels phytoplankton blooms that release carbon dioxide into the water column as they decompose, increasing the acidity of local waters. This is particularly harmful to the growth of clam and oyster larvae.

Using natural soil building practices (mulching) and natural sources of nutrients (organic fertilizers) will result in healthier soils and plants in the long term, reduce the risk of nutrient enrichment of aquatic environments, and help to reduce greenhouse gas production.

Points available

This credit offers 2 base points and 1 monitoring point

Herbicides, Pesticides, and Fertilizers	Base points
Manage landscaping without the use of synthetic pesticides, herbicides, and fertilizers.	**2**
Monitoring Points	
Completion of the Landscape Maintenance Checklist	**1**

How to proceed

Complete the Landscape Maintenance Checklist in Appendix H to show that landscaping is being managed without the use of synthetic herbicides, pesticides, or fertilizers. Use chemicals only in the case of severe infestations, as deemed necessary by a certified professional. Where chemical use is deemed necessary, ensure product label instructions are followed and comply with local bylaws or regulations regarding the use of pesticides and herbicides.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

In some jurisdictions, the use of chemical pesticides, herbicides, and fertilizers is prohibited within a certain distance of a water body (e.g., 50ft (15m) in the City of Seattle). In others, the use of these substances for *cosmetic* purposes is prohibited. Many retailers have information on what products can be used to comply with local pesticide bylaws. In Washington State, BC, and the Maritime provinces, non-cosmetic use for control of pest outbreaks and widespread invasive species must follow an Integrated Pest Management Plan[12] using trained personnel. Information sources on alternative methods for managing pests, weeds, and invasive plant species, along with IPM methods, are listed in the Further Reading section.

The following steps will help to achieve this credit:

- Landscape with native plants or hardy non-native plants that require minimal chemical application, if any. Avoid plants with known susceptibility to disease or those that require high nutrient or chemical inputs to survive in existing soils. Do not use plants identified on local or regional invasive plant lists.
- Avoid or eliminate the use of herbicides to control weeds in lawns and gardens. Rely instead on regular hand-removal of weeds combined with adequate natural soil amendment. Manual removal of weeds can be supplemented with spot treatment using approved insecticidal soaps, vinegar-based compounds, and boiling water.

Figure 3.5.2. Landscape aeration as a lawn and garden best practice. *Credit: Kitchen Food Garden (kitchenfoodgarden.com).*

- Eliminate use of synthetic quick release fertilizers. Use natural amendments that contain all natural ingredients (composted manure, blood meal, bone meal, kelp meal, tea, composted fish-waste, etc.) and no petrochemical or synthetic ingredients. Do not apply approved fertilizers at a rate that exceeds 500g/1lb nitrogen per 90m^2/1,000ft^2.
- Eliminate use of pesticides. Regular maintenance of plant health is the best approach to preventing pest problems. If pest populations cause a widespread and significant decline in plant health on your property, use Integrated Pest Management-approved biological controls. Never use the compounds listed below in shoreline areas.

[12] *Integrated Pest Management (IPM)* combines biological, cultural, physical and chemical tools to manage pests in a way that minimizes economic, health, and environmental risks. IPM is site-specific in nature, with individual tactics determined by the particular crop, pest and environment scenario. The IPM approach places an emphasis on the reduction of pesticide use and the implementation of preventative and alternative control measures (Sustainable Sites Initiative, 2009). Look at IPM guidelines while creating a pest management plan. See Further Reading section for examples.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

Don't use these!

The following compounds pose high risk to salmon and other aquatic species and must not be used in shoreline and riparian areas (from *Salmon-Safe Certification Standards for Residential Development* Draft 2.2).

1,3-dichloropropene 2,4-D Abmectin	Fenamiphos Fenpyroximate Fenbutatin-Oxide
Acephate Altacor Atrazine	Folpet Imidacloprid Iprodione
Bensulide Bentazon Bifenazate	Linuron Malathion Mancozeb
Bifenthrin Bromoxynil Carbaryl	Maneb Metolachlor Metribuzin
Carbofuran Carfentrazone-ethyl Chlorothalonil	Naled Norfl urazon Oryzalin
Chlorpyrifos Copper Sulfate1 Cyhalothrin	Oxyfluorfen Paraquat Dichloride Pendimethalin
Cypermethrin Diazinon Dicamba	Permethrin Phosmet
Dichlobenil Diclofop-methyl Difl ubenzuron	Prometryn Propargite Propiconazole
Dimethoate Disulfoton Diuron	Rimon Quintozene Rimon
Esfenvalerate Ethoprop Extoxazole Technical	Simazine Spinosyn Triclopyr
	Trifluralin Tebuthiuron Thiram

Monitoring

- Post-construction.

Submittals

1. Completed Landscape Maintenance Checklist (Appendix H).
2. Optional: Photos of measures taken to avoid use of synthetic pesticides, herbicides, or fertilizers.

Credit 3.6: Onsite Sewage Treatment

To qualify for this credit, ensure that your onsite sewage treatment system is functioning properly and meets the current standards in your jurisdiction for the minimum distance from a shoreline.

Onsite sewage systems, also known as septic systems, are particularly common in rural and cottage situations. Waterfront properties, which tend to be smaller and have wetter soils, pose extra challenges for septic systems. Soil conditions can make your system less efficient in treating wastewater and allow harmful pollutants to get into the water body you live beside. As a waterfront resident, please pay particular attention to septic system operation and maintenance.

Figure 3.6.1. Pumping the septic system. *Credit: Conasauga River Alliance (www.conasaugariver.org).*

Where this credit applies

This credit applies wherever waterfront properties are not served by a centralized sewage system and rely to onsite sewage treatment, and where those onsite sewage facilities are being installed, renovated, or maintained.

New and existing on-site sewage treatment systems must meet the current standards or regulations for distance from a shoreline of the applicable local jurisdiction, or a minimum 15m/50ft, whichever is greater.

Benefits

Faulty septic systems are extremely hazardous since improperly treated effluent can harm human health (e.g., by getting into drinking water supplies) as well as the health of the environment.

To the homeowner

Untreated sewage can be the source of organic nutrients (particularly nitrogen and phosphates) that lead to eutrophication (an overabundance of algal growth in aquatic systems). Aside from being unsightly, eutrophication of our shorelines prevents waterfront owners and users from swimming, fishing, shellfish harvesting, and other recreational activities. Untreated sewage or malfunctioning septic systems can can also lead to high coliform counts (typically associated with sewage outfalls or drainage from poorly managed septic systems); which can close both freshwater and marine shores to swimming, shellfish harvesting, and other recreational activities. These impacts lead to negative effects on property values.

To the environment

An overabundance of algal growth depletes oxygen levels in the water, which can lead to fish kills and harm other aquatic organisms. Wastewater can also contain other harmful contaminants including oil and heavy metals. Proper onsite sewage treatment including adequate design, installation and maintenance of septic system should prevent the release of these pollutants and nutrients and pollutants to the aquatic system.

Credit 3.6: Onsite Sewage Treatment

Points available

This credit offers 2 base points plus up to 2 bonus points.

Onsite Sewage Treatment	Base points
For an existing onsite sewage treatment system: provide recent inspection documentation signed by a qualified inspector. Indicate the location of any existing sewage treatment structures, including tanks, dispersal field, and outfall if applicable. Any deficiencies identified in the inspection are to be addressed. Provide documentation that the system meets or exceeds regulatory standards including minimum horizontal clearances from watercourses and shorelines. OR **For a new or replacement onsite sewage treatment system:** provide design and installation documentation approved by the local authority. Indicate the location of any new or replacement sewage treatment structure on the site design plan. Provide documentation that the relocated or replacement system meets or exceeds regulatory standards including minimum horizontal clearances from watercourses and shorelines.	**2**
	Bonus points
Replacing and/or relocating the sewage treatment system **specifically** to avoid the risk of erosion. Provide documentation that the relocated or replacement system meets or exceeds the standards in your local jurisdiction for setback from the shoreline, or and minimum 15m/50ft from OHWM/NB/HHWLT, whichever is greater.	**1**
Prepare and follow a septic system maintenance plan (see Appendix I)	**1**

How to proceed

New systems: Installation of new or upgraded onsite sewage systems (OSS) is regulated by county (US), province (Canada), and regulatory authorities:

- In Canada, onsite wastewater systems are to be designed and installed by a registered Qualified Person (QP) or a professional engineer. All onsite wastewater system designs are to meet their respective provincial Onsite Wastewater Guidelines or Sewerage Systems Regulations and submitted to the regulatory authority for approval prior to installation or upgrading. After system construction the QP, engineer, or certified installer will provide the owner with an as-built drawing of the system and a maintenance plan.
- Washington State, state law requires OSSs to be designed by a licensed designer and approved by county health authorities.

To apply for the credit for new systems, submit the installation and maintenance documentation approved by the applicable inspector or authority.

Credit 3.6: Onsite Sewage Treatment

Existing systems: confirm that your OSS meets current regulatory standards with a qualified inspector. In some jurisdictions, for example in San Juan County in Washington State, homeowners are required to have their systems inspected annually for systems within designated sensitive areas (such as shellfish growing areas), and every three years for all other systems. These inspections can be completed by a San Juan County licensed wastewater inspector or a certified homeowner. To become a certified homeowner entails attending a county-sponsored inspection and maintenance workshop.

To apply for the credit for existing systems, submit the inspection and location documentation signed by the qualified inspector and/or professional engineer registered within your local regulatory authority.

Points are available for relocating or replacing an on-site sewage treatment system specifically to avoid the risk of erosion and that meet or exceed the setbacks noted above. Note that there are onsite treatment systems that do not require the large dispersal fields associated with traditional septic systems. These systems may be more suitable for some waterfront properties than the traditional septic and dispersal drain field systems.

Monitoring

See Onsite Sewage System Monitoring Plan in Appendix I or in GSH Monitoring Guide.

Submittals

1. Existing Conditions Plan (Prerequisite 1) showing location of any existing sewage treatment structures and associated infrastructure.

For existing OSS:

2. Recent inspection documentation signed by a qualified inspector or appropriate authority.
3. Proof that any deficiencies identified in the inspection have been addressed.
4. documentation that the system meets or exceeds regulatory standards including minimum horizontal clearances from watercourses and shorelines.

For new or existing OSS:

2. Site Design Plan (Prerequisite 2) showing location of new or replacement system.
3. Design and installation documentation approved by the local authority.
4. Documentation that the relocated or replacement system meets or exceeds regulatory standards including minimum horizontal clearances from watercourses and shorelines.

If applying for bonus points:

5. Documentation that the relocated or replacement system meets or exceeds the standards in your local jurisdiction for setback from the shoreline, or and minimum 15m/50ft from OHWM, whichever is greater.
6. Completed Onsite Sewage Maintenance Plan Checklist (See Monitoring Guide) AND letter indicating commitment to completing monitoring as outlined in Monitoring section above and GSH Monitoring Guide.

Category 3: Water Quality

Canada/General

Fisheries and Oceans Canada. (2019). *Measures to Protect Fish and Fish Habitat.* https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

Integrated Pest Management Council of Canada. (2016). *IPM Council of Canada.* https://ipmcouncilcanada.org/

British Columbia

BC Environment. (2021). *Pesticides and Pest Management.* www2.gov.bc.ca/gov/theme.page?id=9C0666DDF79681160264E5B0EC29ECFB

USA/Washington

Soils for Salmon. (n.d.) www.soilsforsalmon.org
U.S. Environmental Protection Agency (EPA). (2021). *Water Topics.* https://www.epa.gov/environmental-topics/water-topics#our-waters

Visit the Green Shores website for more region-specific resources.

Category 4: Shore Stewardship

The Shoreline Stewardship category encompasses actions that shoreline landowners can take that support not only their own interests, but also public interests, whether they encompass environmental, recreational, educational, or aesthetic values.

In this section:

Credit 4.1: Shoreline Collaboration

To qualify for this credit, work with neighbouring waterfront property owners to design and build common shoreline structures or enhancement measures.

Shoreline features and processes invariably extend across property boundaries which often makes it difficult to address shoreline issues—erosion, deposition, habitat restoration, etc.—solely within the boundaries of one property. Dealing with them in a holistic manner enhances the effectiveness of any measures taken.

Figure 4.1.1. Together neighbours turned this (left) to this (right). *Credit: Coastal Geologic Services Inc.*

Where this credit applies

This credit applies to shoreline protection or enhancement projects that neighbouring property owners could work together and address collectively, such as:

- Removal of hard armouring that extends across two or more properties (Credit 1.3).
- Removal of groins that are shared or multiple groins on two or more properties (Credit 1.4).
- Nature-based protection measures that extend across properties (Credit 1.5).
- Riparian and emergent vegetation landscaping that share a common landscaping plan for more than 75% of the riparian buffer across properties (Credit 2.2).
- Stormwater management and drainage works that provide a common, shared service, including sharing of impervious surfaces such as driveways or walkways (Credit 3.2).
- Onsite sewage treatment; for example, common septic fields or small plant systems (Credit 3.7).

Note that sharing overwater structures (common piers, docks, etc.) and shoreline accesses are already recognized and awarded points under Credits 2.6 and 2.7 respectively, so you cannot apply for collaborating on these types of projects under this credit as well.

A collective application is encouraged if the shoreline project is contiguous and comparable across all properties involved. However, whether collaborating properties/owners are rated individually or collectively would depend on the nature of the projects and/or interest of the owners involved:

- If only some of the owners are interested in being rated and they are not contiguous, then rating would be on an individual basis.

Credit 4.1: Shoreline Collaboration

- If all owners are keen to be rated, then a collective application should be encouraged.
- However, if one or a subset of the properties involves more development than the collaborative shoreline project (e.g., upland redevelopment) and that development could be eligible for credits, there should likely be an independent application for the property with additional, eligible development activities.

You can apply for points under this credit whether or not your neighbours are applying for their own Green Shores for Homes rating; obtaining points under this credit is independent for each applicant.

Benefits

To the homeowner

Shoreline measures may be more effective from a protective, cost, recreational or aesthetic perspective if conducted over several properties, rather than just a single property. Homeowners can also realize economies of scale in collaborating with one another; for example, hiring common experts, sharing, and paying for one design versus many designs (which may or may not be compatible), buying supplies and materials in larger quantities at discount, disturbing less ground collectively, etc.

To the environment

Since shoreline features typically extend across property boundaries, dealing with them holistically enhances the effectiveness of any measures taken to protect property or enhance natural features along the shoreline. In most cases, the greater the number of adjacent properties involved, the greater the portion of the natural system that can be preserved and enhanced.

Points available

This credit offers up to 8 base points.

Shoreline Collaboration	Base points
Collaborate with one other (separate)* waterfront property owner.	**4**
Collaborate with two (separate)* waterfront property owners.	**6**
Collaborate with three or more (separate)* waterfront property owners.	**8**

***The collaborating parties must be different owners; i.e., not one owner for two or more properties.**

How to proceed

Collaboration starts with talking with your neighbours about common concerns, ideas, and solutions. In setting up a collaborative shoreline project, think about:

- Communication methods: Agree upon how you wish to communicate with one another for different aspects of the project; for example, meetings, email, phone calls, etc. At all times, allow the viewpoints and perspectives of all members to be considered in decision-making. Perhaps designate a team member as responsible for overseeing the collaborative communication process.

- Common goals: Determine the goals (both short- and long-term) that everyone can agree on to guide your project.
- Targets: Agree on a timeline and specific measurables for achieving your goals.
- Responsibilities: Identify the major tasks and who will be the lead on each task. For example, who will be in charge of contacting prospective contractors and getting quotes that all can review? Who will be the main contact for the contractor chosen? Who will oversee the actual site activities? Who will be the treasurer, keeping the books, collecting funds from each team member, etc.?
- Maintenance: Agree on a maintenance plan, if applicable, with associated assigned responsibilities and financial contributions.

Make sure to document the collaborative effort in order to achieve this credit, including:

- Project team members: name, address, roles, etc.
- Summary of the communication methods, management process, and responsibilities, etc.: Provide a record or log of major milestones.
- Collaborative construction and maintenance plans.

A collaborative process may take longer than 'going it alone' and may require some compromise, but the overall benefits in terms of reduced costs per individual, environmental protection, and a better end product often outweigh these disadvantages. Plus, you and your neighbours may develop a greater sense of community. In addition, collective projects may be considered to provide a higher level of public benefit and could be eligible for funding or tax credit programs through local, state/provincial, or federal agencies. Check with your local government.

Monitoring

Since this credit applies only to the planning and construction phase of a project, three-year monitoring is not applicable. Any applicable monitoring and associated points will be awarded under the credit that the collaborative action applies to (e.g., monitoring bonus points for nature-based protection measures across multiple properties, would be awarded under Credit 1.5).

Submittals

1. A list of owners and their properties participating in a common shoreline protection or enhancement project.
2. Map or lot plan showing locations of participating properties.
3. Photos (that span more than one lot) before and after project construction.

Credit 4.2: Public Information and Education

To qualify for this credit, provide opportunities to learn about the Green Shores measures taken on your property.

The intent of this credit is to promote understanding and uptake of Green Shores practices by waterfront property owners, developers, contractors, the professional community, and the general public.

Figure 4.2.1. Green Shores signage. *Credit: H. Rueggeberg.*

Where this credit applies

This credit applies to any shoreline development activities that can be demonstrated to the public. **This credit cannot be combined with the actions taken in Credit 2.1 to promote enhanced critical, sensitive, and migratory bird habitat stewardship.**

Benefits

To the homeowner

Providing opportunities to learn about a Green Shores project displays your commitment to "doing the right thing" when it comes to your shoreline, and encourages other property owners, especially those "on the fence" to do the same. If they are your neighbours, getting them informed and involved increases the effectiveness of shoreline protection and restoration projects.

To the environment

Impacts to shoreline ecosystems from waterfront development are not always well recognized by planners, developers, and property owners. Communication of Green Shores approaches to the professional community and the public is essential in order to build awareness of shoreline development issues and develop knowledge and expertise to address these issues.

Credit 4.2: Public Information and Education

Points available

This credit offers up to 3 base points

Public Information and Education	Base points
Provide one public education measure regarding your shoreline project; OR	**1**
Provide two or more public education measures regarding your shoreline project; OR	**2**
Provide three or more public education measures, one of which is hosting an on-site open house or public demonstration about your shoreline project.	**3**

How to proceed

Examples of public information opportunities include (note that these actions are neither mutually exclusive nor exhaustive— be creative!):

- Signs or posters on the property boundary explaining the Green Shores process and product and why it is good for the shoreline environment. This includes using a sign template offered by your local agency.
- Scheduled public tours and onsite demonstrations.
- Articles in newspapers and magazines.
- Public and school presentations.
- Creation of social media posts.
- Documentation of the Green Shores approach on the Green Shores website and optionally, the local government's website and/or the owner's website.
- Volunteer advisory services, where the Green Shores property owner provides advice to other waterfront owners.
- Creation or participation in a shoreline stewardship program for waterfront owners.

You may choose to design and carry out these information actions yourself, or you could collaborate with—or allow your local government, contractor, service providers, or a local business, community, or environmental organization—to use your project for educational purposes. Any information provided through posters, written materials, or electronically should, at a minimum:

- Describe the site values, shoreline ecological and physical processes.
- How the site design works with these features.
- How one or more Green Shores credits have been addressed.
- Be available for at least one year.
- Be creative with photos (especially before and after) and graphics. Invite neighbours to join you in your efforts.

Credit 4.2: Public Information and Education

Monitoring

- Post-construction.

Submittals

1. Brief explanation of the information/education measure.
2. Photo or copy of the information/education measure.

Credit 4.3: Conservation Easement or Covenant

To qualify for this credit, establish a conservation covenant or easement on a waterfront property, or a portion thereof, that protects natural features of the shoreline.

A conservation covenant (Canada) or conservation easement (United States) is a voluntary, legally binding agreement between a landowner and a covenant/easement holder in which the landowner promises to steward the land in ways that are specified in the covenant. A covenant/easement holder may be a government or a non-government organization that is recognized under applicable federal, provincial, or state legislation as being able to hold covenants such as a land trust or nature conservancy. The covenant holder enforces the provisions of the covenant/easement if the owner does not abide by its terms.

Figure 4.3.1. *Credit: H. Rueggeberg.*

A special attribute of a conservation covenant or easement in both Canada and the US is that it is registered on the title of the property, ensuring that it binds all current and future owners of the land. In this way, the protection that the covenant bestows is permanent and runs with the land.

Where this credit applies

This credit applies to any waterfront property. A landowner may establish a conservation covenant or easement on all or a portion of their property at any time if they and a covenant holder agree that the ecological values of that property should be preserved.

Benefits

To the homeowner

Conservation covenants/easements are of greatest interest to landowners who wish to preserve the ecological values of their properties regardless of who may own it in the future. In some jurisdictions, a conservation covenant may make the property eligible for reduced property taxes; for example, under the Public Benefit Rating System in King and San Juan Counties, Washington, and the Natural Area Protection Tax Exemption Program in the Islands Trust Area in BC. (See the Further Reading section below for details.)

In Canada, conservation covenants on ecologically sensitive lands may also qualify as ‘ecological gifts’ under the federal *Income Tax Act* and be eligible for income tax credits (deductions from taxable income). Similarly, landowners in the US who donate a "qualifying" conservation easement to a qualified land protection organization under the *Internal Revenue Code* may be eligible for a federal income tax deduction equal to the value of their donation. In both countries, the value of the covenant or easement donation, as determined by a qualified appraiser, equals the difference between the fair market value of the property before and after the covenant/easement takes effect.

Credit 4.3: Conservation Easement or Covenant

To the environment

The main benefit is permanent protection of key ecological features and functions of the shoreline and restrictions on activities that could harm them. Private lands often contain ecological, cultural, heritage, aesthetic and recreational values that are highly significant. Conservation covenants/ easements offer a cost-effective alternative to outright purchase of lands for the purposes of protecting these values. They allow landowners and conservation organizations to play an important role in the protection of ecologically significant lands that are important to us all.

Points available

This credit offers up to 6 base points.

Conservation Easement or Covenant	Base points	
	Mandatory (required by local jurisdiction)	Voluntary
Place a conservation easement or covenant on a minimum 20m/60ft wide buffer* along 100% of your shoreline	**3**	**6**
Place a conservation easement or covenant on a minimum 10m/30ft wide buffer along 100% of your shoreline	**2**	**4**
Place a conservation easement or covenant on a minimum 10m/30ft wide buffer along 75% of your shoreline	**1**	**2**

*Buffer is measured perpendicular inland from the ordinary high water mark or natural boundary.

How to proceed

In some US jurisdictions, a covenant is mandatory on all shoreline vegetation and plantings under their respective Shoreline Master Plans. These mandatory covenants are still recognized under this credit but with fewer points than covenants that are entered into voluntarily.

For a voluntary covenant, if your waterfront property has ecological values, decide whether you are willing to put restrictions on your property on a permanent basis in the interest of preserving natural shoreline features. For instance, a conservation covenant usually places restrictions on future development of a property, and thereby may reduce the property's market value or saleability. To fully understand the costs and implications, seek advice from an organization that holds conservation covenants or easements, other landowners who already have covenants/easements on their properties, and/or a lawyer who is experienced with conservation covenants/easements.

If you want to go ahead with establishing a covenant on your property, identify an appropriate covenant holder (recipient) such as a local land trust organization or local government. Things to consider in finding an appropriate covenant holder include whether the holder organization has conservation objectives that fit well with your objectives regarding the special features of your property; and whether the organization has a solid record and adequate human and financial resources to undertake covenant obligations, including long-term monitoring and enforcement.

Credit 4.3: Conservation Easement or Covenant

Basic steps to take for you and your proposed covenant holder are:

- Identify the land (the entire property or portion thereof) to be protected under the covenant.
- Identify the characteristics of the land that are to be permanently protected - special natural features, important habitats, etc.
- Determine the stewardship practices that will best protect those characteristics; for example, leaving it alone, fencing, etc.
- Obtain legal and tax advice.
- Conduct an environmental assessment of the property to ensure it fits within the conservation objectives of the conservation organization and to disclose any outstanding liabilities connected with the land; for example, existing liens on the property, environmental contamination.
- Negotiate the terms and conditions of the conservation covenant/ easement. Examples of Green Shores-based provisions might include:
    - Permanently maintain a shoreline riparian buffer as well as acceptable and unacceptable activities in the buffer.
    - No shoreline structures (for example, bulkheads, seawalls, piers, docks, etc.) to be constructed except in accordance with the covenant.
    - No subdivision of the property except in accordance with the covenant.
    - Preserve specific shoreline features present on the property; for example, a bluff ecosystem, trees, etc.
    - Preserve rain gardens on the property that manage site drainage so as to minimize impacts on the shore.
    - No impervious surfaces to be constructed.
- Have a survey and/or appraisal completed, if necessary.
- Prepare a management plan and management agreement, where necessary.
- Prepare the conservation covenant document.
- Execute the covenant and register it on title.
- Over the long term, monitor the land as agreed in the conservation covenant.

Monitoring

Since this credit is intended for permanent, legal protections of a shoreline or property, monitoring is not applicable.

Submittals

1. Copy of the conservation covenant or easement that is registered on title.

Credit 4.4: Shoreline Stewardship Participation

To qualify for this credit, involve your project in an environmental program that benefits shoreline areas.

A variety of environmental stewardship programs that assist waterfront homeowners are run by local, provincial/state, and national organizations, both government and non-government based. Some local governments and non-government group run 're-tree' programs to help plant areas lacking in tree cover. 'Naturescape' programs assist landowners in adding habitat features in their yards and gardens. There may also be shoreline preservation and restoration programs that offer advice, materials, and incentives for environmentally friendly shore landscaping.

Where this credit applies

This credit applies to any project on waterfront properties in marine and lake environments. **This credit cannot be combined with the actions taken in Credit 2.1 to promote critical, sensitive, and migratory bird habitat stewardship in collaboration with local conservation groups.**

Benefits

To the homeowner

You can benefit from the advice and assistance (physical or financial) that sponsored programs offer, as well as increase the effectiveness of your actions by participating in concert with others.

To the environment

Participation in a shoreline program supports actions that take broader shoreline functions into consideration and puts the activities on a single property into the appropriate ecological and biophysical context.

Points available

This credit offers 2 base points.

Shoreline Stewardship Participation	Base points
Integrate the project with an environmental program aimed at shoreline protection, restoration, or enhancement.	**2**

How to proceed

You can find out about applicable programs in your area by contacting your local government, who may offer such programs or suggest non-government organizations that can be of assistance. Some provincial, state, or national organizations conduct programs on a local scale; visit the website of such organizations to see if they have a program in the local area. Some examples are provided under the Further Reading section below.

Participation in shore stewardship programs will help keep your information current and provide you with live links to events, presentations and people who know and care about the shore.

Credit 4.4: Shoreline Stewardship Participation

Monitoring

Three-year monitoring is not applicable to this credit.

Submittals

1. Brief explanation of the shoreline stewardship program in which the applicant/project is involved.

Category 4: Further Reading

Category 4: Shore Stewardship

Check with the local conservancy or land trust in your area - many have developed their own guides to conservation covenants and easements.

British Columbia

Islands Trust. (2022). *Natural Area Protection Tax Exemption Program (NAPTEP)*. https://islandstrust.bc.ca/programs/natural-area-protection-tax-exemption-program/

Land Trust Alliance of British Columbia. (2018). *Information for Landowners.* https://ltabc.ca/resources/natural-legacies-toolkit/information-for-landowners/

United States

Washington State Department of Ecology. (n.d.). *Shoreline planners toolbox.* https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-planners-toolbox

Puget Sound Partnership. (2022). www.psp.wa.gov/

Atlantic Provinces

Island Nature Trust. (2018). *Protecting Natural Places in Prince Edward Island: Options for the Landowner*. https://www.islandnaturetrust.ca/wp-content/uploads/Private-Stewardship-Options-Booklet-Full-Page.pdf

Nature Conservancy Canada. (2020). *Newfoundland and Labrador.* https://www.natureconservancy.ca/en/where-we-work/newfoundland-and-labrador/

Nature Trust of New Brunswick. (2019). *Conservation Options for New Brunswick Landowners*. https://static1.squarespace.com/static/5e848a775a3fc437adc257db/t/5e95b2b55778131bfc231562/1586868939059/2019_Conservation%2BOptions_Web.pdf

Nova Scotia Nature Trust. (2022). https://nsnt.ca/

Nova Scotia Nature Trust. (n.d.). Conservation Options for Landowners. https://nsnt.ca/wp-content/uploads/17-11-24-ConservationOptionsBooklet_web.pdf

Glossary

The following definitions are solely for the purpose of the *Green Shores for Homes Credits and Ratings Guide* and submittals. Note that many are adapted from the *Marine Shoreline Design Guidelines* (Johannessen et al., 2014).

Absorbent landscaping: Landscaping characterized by deeper, organic soils or in the case of forests, a thick duff cover. Soils in absorbent landscaping should have 10-25% organic content and minimum 300 mm (12 inches) depth. Absorbent landscapes incorporate herbaceous vegetation (shrubs, grasses with thick root mats) and trees.

Accretion: The gradual accumulation of sediments by natural causes (wave and tidal processes) in the foreshore and along the shoreline. Accretion at any specific site may be episodic and broken by periods of erosion that are often associated with large storm events.

Armour/Armouring: Rigid, permanent design techniques used to stabilize shorelines and prevent erosion.

Backshore: The upper zone of a beach (or land above the Ordinary High Water Mark (OHWM), Natural Boundary (NB), Highest High Water Level Tide (HHWLT)) beyond the reach of normal waves and tides, landward of the beach face. The backshore is subject to periodic flooding by storms and extreme tides, and is often the site of dunes and back-barrier wetlands (Figure H).

Bank or Bluff: A steep slope rising from the shore, generally formed by erosion and mass wasting of poorly consolidated material such as glacial or fluvial sediments. In marine systems, the term bluff is typically used for a steep sea cliff composed of unconsolidated sediment that has no to moderate amounts of vegetation. The term bank is typically used in the Northwest for lower elevation sea cliff with a well vegetated bank face. Coastal banks are generally less then 5m/5ft in height and coastal bluffs greater that 5m/15ft in height.

Beach: The gently sloping zone of unconsolidated sediment along the shore that is moved by waves, wind, and tidal currents. Width is measured cross-shore from the break in slope between the upper beach and the low-tide terrace and the waterward extent of the backshore.

Beach Nourishment: A shore protection works in which sand or sediments lost by longshore drifts or erosion are replaced on a certain area of a beach. It involves the transportation of sand or other materials from other areas to the affected area. Beach nourishment can both protect uplands from erosion and contribute to important coastal processes such as longshore drift; however, many nourished beaches must be maintained with periodic additions of sediment, as the sea will continue to erode them.

Berm: A low shelf or narrow terrace on the backshore of a beach formed of material thrown up and deposited by storm waves.

Boulder-cobble beach: A beach made up of a mixture of boulder and cobble gravel sediment. Boulder: a specific size class of gravel sediment greater than 256mm (10.1in) in median diameter. Cobble: a specific size class of gravel sediment 64-256mm (2.5-10.1in) in median diameter.

Building - major: Refers primarily to a house or primary residential building on a property.

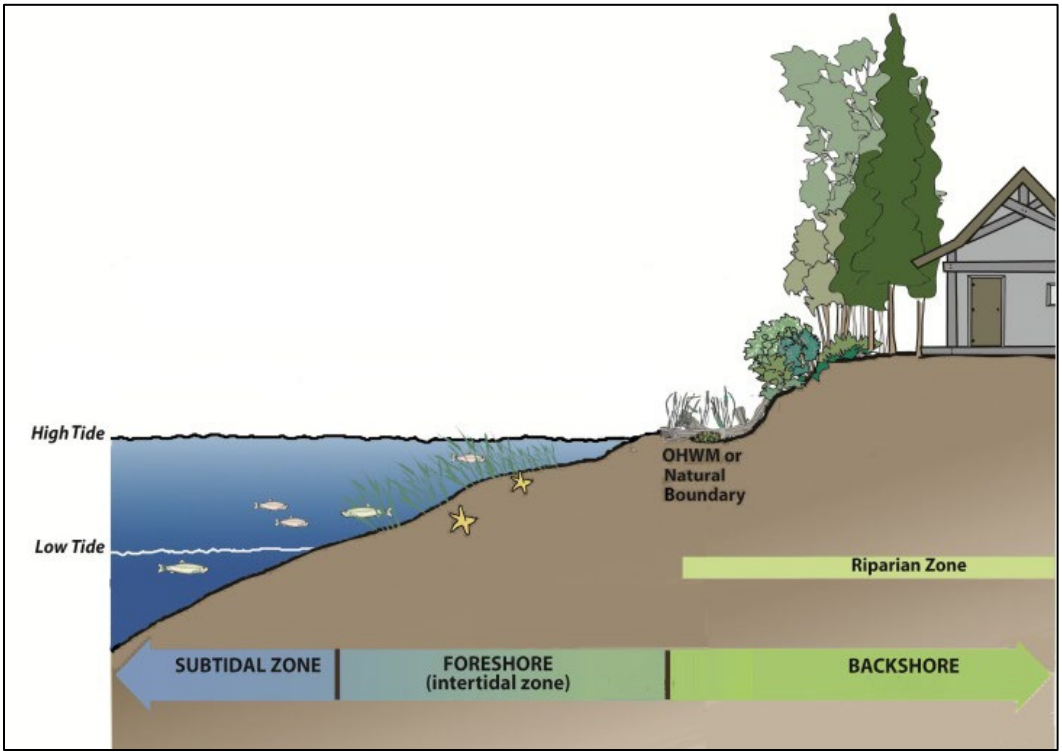


Figure H. Parts of the shore—marine example. *Credit: Stewardship Centre for BC.*

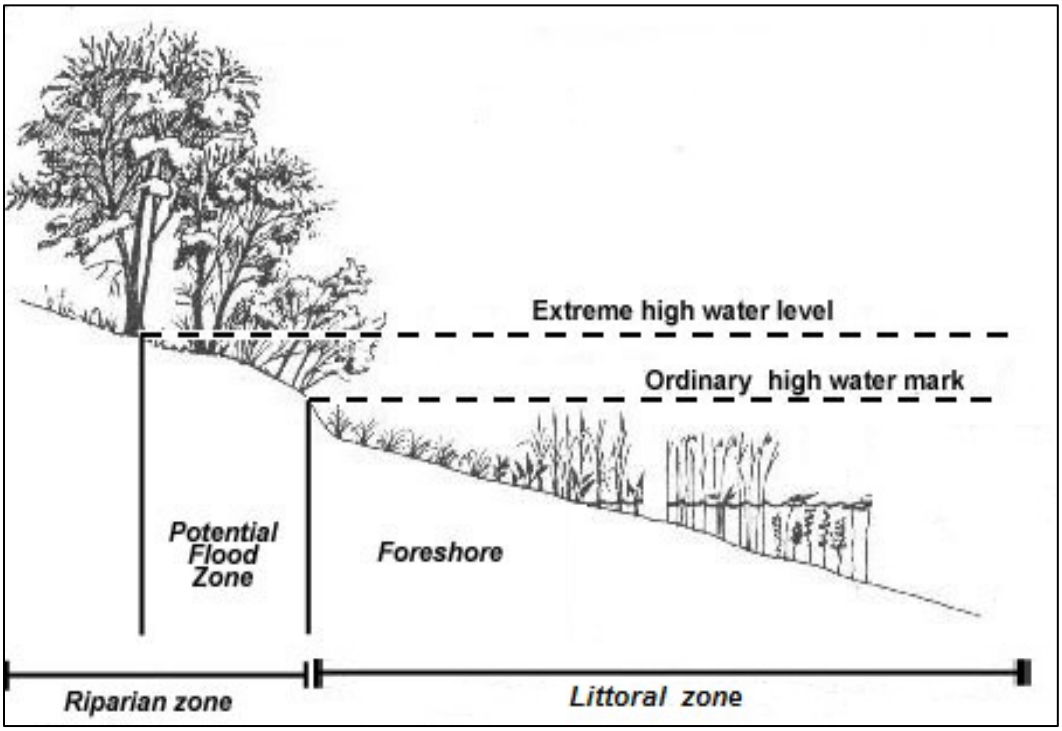


Figure I. Parts of the shore—lake example. *Credit: Fisheries and Oceans Canada.*

Building - minor: Refers to secondary buildings on a property such as a garage, shed, gazebo, patio, deck, etc.

Bulkhead: A general term for shore armour structures that run parallel to the shore and designed to protect against wave attack or serve as a retaining wall. It includes seawalls, revetments, riprap, and gabions.

Cliff: Steep coastal slopes where rock formations are exposed.

Climate change: Long-term changes in average temperature, precipitation, and weather events such as storm frequency and intensity.

Coastal: In this guide, the term coast or coastal applies to both marine and lacustrine coasts.

Coastal squeeze: The loss of natural habitats or deterioration of their quality arising from anthropogenic structures or actions, preventing the landward transgression of those habitats that would otherwise naturally occur in response to sea level rise in conjunction with other coastal processes. Coastal squeeze affects habitat on the seaward side of existing structures.

Contaminated Sites: A previously developed shoreline site (generally industrial) with contaminant levels that exceed regional, provincial, or federal standards for residential/commercial development.

Critical or Sensitive Habitats:

1. Areas providing important feeding, resting, spawning, nesting, or rearing habitat for federal or provincially designated rare or endangered species.
2. Federally, provincially, or regionally designated Environmentally Sensitive/Significant Areas (ESA), Protected Natural Areas, National Parks, Nature Reserves.
3. Valued foreshore habitats including estuaries, marshes, lagoons, eelgrass beds, kelp beds, commercial/recreational/First Nation clam beds, tidal channels, important spawning and rearing areas for fish, seabirds, and marine mammals.

Diameter at breast height (DBH): A standard method of expressing the diameter of the trunk of a tree; commonly measured at 1.3m (4.5ft) from the ground.

Drift cell: The nearshore area that includes a sediment source, a transport zone, and a deposition zone (Figure J and Figure K). The cell boundaries delineate the geographical area within which the budget of sediment is balanced, providing the framework for the quantitative analysis of coastal erosion and accretion. Drift cells repeat along the shore, sometimes with smaller cells nesting in larger cells.

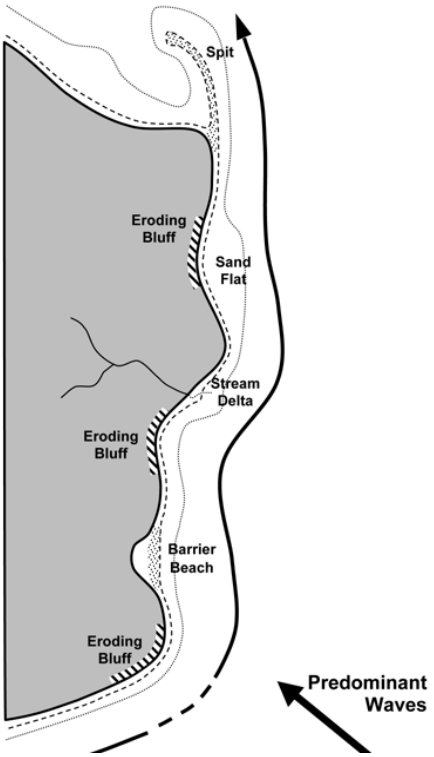


Figure J: A typical drift cell extending from the eroding bluff at the bottom to the spit at the top. *Credit: Shipman, 2008; p.11.*

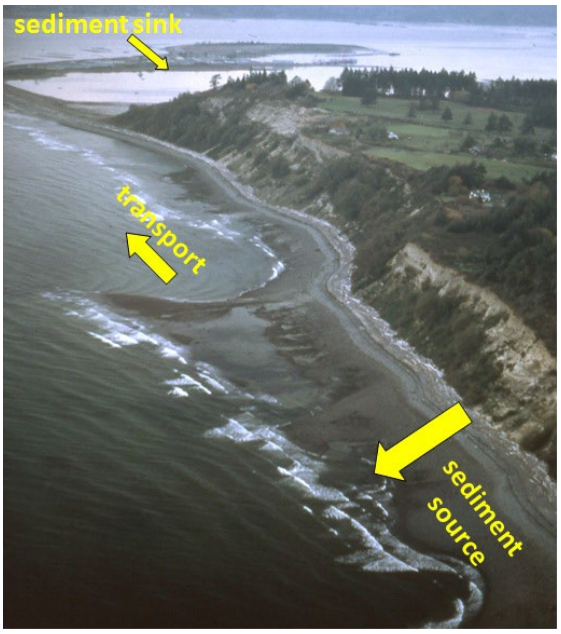


Figure K: Example of a drift cell—Goose Spit near Comox B.C. *Credit: Stewardship Centre for BC.*

Ecosystem function: The natural processes and structures through which we benefit from shore environments such as production of forage fish or wave attenuation. Functions are roughly synonymous with goods and services.

Emergent vegetation: Plants that thrive in partially submerged conditions in freshwater environments. Examples of emergent plants are cattails, bulrushes, and sedges.

Erosion: The wearing away of land by natural forces; pertaining to a beach, the removal of beach material by wave action, tidal currents, littoral currents, or wind action (opposite of accretion). Erosion may be long-term (occurs over decadal or greater scales) and short-term (occurs at less than decadal scale due to individual storm events or seasonal variability).

Feeder (or eroding) bluff: A bluff usually composed of glacial sediment that serves as sediment source for beaches in a drift cell. In the marine environment, it is a coastal bluff with active erosion and/or mass wasting that supplies moderate volumes of sediment to the nearshore. The bluff face typically has vegetation indicative of disturbance with evidence of landslides and toe erosion.

Fetch: Open water distance over which a wind can blow unimpeded and form waves.

Flood Construction Level: The Designated Flood Level plus the allowance for freeboard used to establish the elevation of the underside of a wooden floor system or top of concrete slab for habitable buildings. In the case of a manufactured home, the ground level or top of concrete or asphalt pad on which it is located, is equal to or higher than the above described elevation (from BC Flood Hazard Area Land Use Management Guidelines).

Foreshore: The area between high tide or Ordinary High Water Mark and low tide water levels in marine systems (Figure H), or between seasonal high water and low water levels on lakes (Figure I).

Gravel-sand beach: A beach made up of a mixture of gravel (rock fragments of 2-64mm (0.08 - 10in) median diameter) and sand (loose grains of 0.0625-2mm (0.0025-0.08in) median diameter).

Greenfield: Natural shoreline that has not been impacted by human activity, specifically by the removal of marine riparian vegetation or construction of shore protection structures such as bulkheads or groins. It is possible for a previously developed site with an existing natural shore to be designated a green field shore.

Groin: A wall built perpendicular to the shoreline, intended to trap sand, and deflect waves away from the beach. Sediments being carried by longshore drift will accumulate on the forward edge of a groin and erode on the opposite side of the structure. Also spelled groyne.

Higher High Water (HHW): The higher of the two daily high tides for diurnal or semi-diurnal tides.

Higher High Water Large Tide (HHWLT): The average of the highest high waters for each year of the 19-year prediction cycle referenced to Chart Datum. HHWLT for reference tidal stations are found in the Canadian Tide and Current Tables published by the Canadian Hydrographic Service.

Impervious: Not capable of absorbing or filtering water; water instead runs off the surface.

Impervious Surface Area (ISA): The area of a given lot or property that is covered by man-made structures such as rooftops, roads, sidewalks, driveways, and parking lots that are covered by impenetrable materials such as shingles, asphalt, concrete, plastic, brick, and stone. The ISA is often referred to as the built footprint.

Infrastructure: Structures that provide services for buildings or human activities. Major infrastructure refers to structures that provide essential services such as sewer, water lines, electrical, and cable services and roads. Minor infrastructure includes things such as driveways and walkways.

Intertidal zone: In marine systems, the area between high tide and low tide levels that is flooded daily by the tide, also termed foreshore (Figure H).

Large woody debris (LWD): Large logs with or without root masses attached and can also include separate root masses.

Littoral zone: A general term referring to the part of the sea or lake that is close to the shore (Figure I).

Littoral, longshore, or net shore drift: Interchangeable terms that refer to the forces of erosion, transport, and deposition that combine to create movement of sediment parallel to the shore. These forces include waves that approach the shore at an angle, and a longshore current of water moving along the shoreline in the direction of wave movement. In marine systems, tidal currents are also involved. Sediment moves in a series of angled “in and out” directions that, overall, moves in a “net” direction along the shore.

Low impact development (LID): Techniques and measures to reduce rainwater runoff, encourage rainwater infiltration into the ground, and remove any contaminants from runoff prior to flowing into receiving water bodies.

Monitoring: Observing the effect and/or effectiveness of an action to determine whether that action has a positive, negative, or neutral effect on ecological or physical processes on the site. Monitoring can also indicate whether an action is having the desired effect, and whether any changes are required.

Monitoring typically requires a record of before and after an activity is completed; it can also include project features or indicators than can be measured before and after construction.

Natural boundary: The visible high water mark of any lake, stream, or other body of water where the presence and action of the water are so common and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river stream, or other body of water a character distinct from that of the banks, both in vegetation and the soil itself (Figure H and Figure I).

Nature-based solutions: Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (IUCN).

Nearshore: A general term that encompasses the foreshore (intertidal) and shallow depth (subtidal) zones.

Ordinary high water mark (OHWM): The highest level reached by a body of water that has been maintained for a sufficient period of time to leave evidence on the landscape (Figures H and I). That evidence is "indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." (Federal Regulations 33 CFR 328.3(e)). In both marine and freshwater systems, the natural boundary or OHWM is usually the point at which natural vegetation shifts from hydrophytic (water-dependent) species to terrestrial species.

Overhanging vegetation: Vegetation that extends at least 0.3m (1ft) out over the water and provides shade for most of the day (unlike upright riparian vegetation that may throw a shadow only at certain times of day). Trees such as alder, native maples, willows and tall shrubs such as ocean spray and red-osier dogwood can become excellent overhanging species.

Overwater structure: This includes any pier, ramp, float, covered moorage, boat work shed, walkway, and mooring pile.

Permeable or pervious: Able to absorb or filter water.

Qualified Coastal Professional (QCP): An engineer, geoscientist, or geotechnical engineer in good standing with their professional organization, acting within their abilities and with demonstrated experience and/or training pertaining to shore protection and coastal processes. Many coastal professionals experience also applies to larger lake shores.

Qualified Environmental Professional: A professional habitat biologist, landscape architect, environmental land use planner or other suitably qualified professional in good standing with their professional organization, acting within their professional abilities with expertise in shoreline ecology and habitat function.

Qualified Person: A registered onsite wastewater system practitioner according to their governing Canadian provincial requirements.

Qualified Stormwater Professional: A water resources engineer in good standing with their professional organization, acting within their abilities and with demonstrated experience and/or training pertaining to hydrologic and hydraulic processes.

Return wall: A section of bulkhead that extends towards land, typically from the end of a bulkhead, and ties into the bank or backshore.

Revetment: A hard armour technique using stone placed on a sloping bank to protect against waves or currents.

Riparian: Reference to the area immediately next to water that acts as an interface between water (fresh and marine) and land. The riparian area/zone is the transitional zone between the upland and aquatic environment where riparian vegetation is located (Figures H and I).

Riparian Area or Zone: The area of transition that links aquatic and terrestrial ecosystems and includes existing and potential riparian vegetation (defined below). The riparian area provides habitat for aquatic species, organic input to the nearshore environment, a buffer for adjacent upland from erosional processes, and retention of stormwater runoff (see accompanying graphic at end of Glossary).

Riparian buffer (RB): The shoreline area that lies within the minimum riparian buffer OR setback required by the local jurisdiction OR within 10m (35ft) of the OHWM (measured as the horizontal distance landward of the OHWM), whichever is greater.

Riparian Vegetation: Trees, shrubs and grasses specifically adapted to the riparian environment. In general, these are species native to the site area; however they may also include suitably adapted non-native (but non-invasive) plant species.

Riprap: Broken (fractured) rock, cobbles, or boulders placed on earthen surfaces, such as the face of a dam or the bank of a stream, for protection against action of water (waves).

Runup: The rush of waves up the face of a beach or structure produced by breaking waves. The maximum vertical height of water above still water level is the measure of runup.

Sea level rise (SLR): The increase in sea level attributed to the effects of climate change.

Seawall: A shoreline armouring technique utilizing vertical or near vertical reinforced concrete or rock wall. Also referred to as a vertical bulkhead.

Sedimentation: When soil particles suspended in the water settle on stream, lake, or seabeds.

Setback: Distance of the nearest major building or infrastructure from the OHWM, or on bluff sites, measured from the bluff crest or break in slope landward.

Shoreline Processes: Natural processes that shape the physical characteristics of shores.

There are three key shoreline processes:

1. Waves – Wind waves are the primary force in the coastal zone, creating most of the erosion, sediment transport and deposition that form beaches, sand spits, and other coastal shore features.

2. Sediment Movement – Sediment, where it is available on the coastal shore, is constantly moving with the waves and currents towards, away from, and along the coast.

3. Water Levels – Water levels on the coast vary according to the twice-daily tides, surges caused by storms, and, over longer periods of time, changes in North American sea levels due to climate change or other global events. Water levels on lakes seldom change, but reservoirs may fluctuate based on management actions.

Soft shore protection: Shore protection design which entails the use of indigenous materials such as gravel, sand, logs, and root masses in designs that have some degree of flexibility, mimicking natural processes.

Glossary

Shore or shoreline protection structure: Any bulkhead, groin or other built structure used to protect a shoreline from erosion.

Storm surge: A rise of water associated with the influence of low-pressure weather systems, wind setup, and wave setup.

Subtidal zone: In marine systems, the area below low tide level but still relatively shallow and close to shore, typically to a depth of about 35 feet (10m) (Figure H).

Wrack or beach wrack: Organic material such as kelp and sea grass and other flotsam (plastic, glass, metal debris) that are cast up onto the beach by surf, tides, and wind. The "wrack line" usually marks the high tide line for that day. The organic portions of wrack provide food and habitat to many species that inhabit the shoreline, including insects and birds. Wrack also provides an incubator to grasses and other plants which grow along the shoreline and help to anchor dunes.

Appendices

In this section:

Appendix A: Existing Conditions Plan Checklist

EXISTING CONDITIONS PLAN All boxes must be checked off
Existing Conditions Site Plan (pre-construction) shows: (note, one or more sheets may be used as deemed appropriate by the design team) ☐ North Arrow ☐ Scale Bar ☐ Property Owner and Address ☐ Who drew the plan and date drawn ☐ Lot boundaries and dimensions ☐ Position of Ordinary High Water Mark (OHWM) or Natural Boundary (NB) ☐ Location of buildings and structures shown to scale on the site plan, including any existing structures below the Natural Boundary ☐ Spot elevations given for the property and shoreline, along with elevation contours at 0.5m/1.5ft intervals. Vertical Datum to be noted on the drawing notes. ☐ Type of beach – bedrock or sediment based. If latter, indicate general nature – boulders, cobble, gravel, sand, mud, or a mix of any of these sediment types ☐ Riparian vegetation – general extent and nature of plant species ☐ Condition of shoreline – eroding, accreting, or stable (can be a note on existing site plan) ☐ Location of building setback(s) required by local code or regulation ☐ Any streams, wetlands, and their buffers shall be denoted on the existing site plan ☐ Existing shore protection structures, and any docks and marine infrastructure on site ☐ Aerial photo of property and a photo of existing conditions

Appendix B: Site Design Plan Checklist

Site Plan Drawing Package **All boxes must be checked off**
Provide a drawing package of the proposed shoreline design. Drawings should have: ☐ Scale Bar ☐ North Arrow ☐ Property owner and address ☐ Who designed the project and date drawn (typical information found in a drawing title border) ☐ Lot boundaries and dimensions ☐ Ordinary High Water Mark (OHWM) or Natural Boundary (NB) ☐ Both existing and new buildings and structures, including accesses and pedestrian paths ☐ Location of building setback(s) required by local code or regulation ☐ Any changes to riparian or other vegetation, if applicable Minimum required drawing sheets include: ☐ Plan view to scale showing project elements clearly, including all areas that extend onto Crown Land ☐ Excavation drawing sheet (if relevant) of any excavations ☐ Cross section view(s) ☐ Riparian zone plan view sheet. A scaled site plan showing the location and typical species composition of the existing riparian zone and clear indications of any removals, planting, and re-vegetation by the project ☐ Plan showing existing critical or sensitive habitat overlaid over project plan ☐ Site access drawing sheet. Site plan indicating where equipment will access the shoreline, and extent of any work areas including all site access and lay-down areas for the project. This drawing sheet shall also show extent of any critical or sensitive habitat

Appendix C: Critical or Sensitive Habitats Checklist

SITE PLAN SHOWING CRITICAL OR SENSITIVE HABITATS All boxes must be checked off
Provide a site plan showing **Critical or Sensitive Habitat**: ☐ On the Existing Conditions Site Plan (or on a separate plan sheet), show the nature and location of designated or identified critical or sensitive habitats and their buffers: ☐ Shows critical or sensitive habitat on the property and the foreshore adjacent to site (including riparian, foreshore, subtidal/littoral zone), and along the shoreline extending at least 50m each side of the property lines

Appendix D: Nature-based Shoreline Protection Options

The following are nature-based protection options and/or aspects that can be integrated into a hybrid shoreline protection strategy to help support the efficacy of the nature-based protection option. For more information about integrating hard and soft shoreline elements into a hybrid option on Canadian coasts, see Rising Tides and Shifting Sands (https://www.weadapt.org/knowledge-base/nature-based-solutions/rising-seas-and-shifting-sands-combining-natural-and-grey-infrastructure-to-protect-canadas-coastal-communities).

Appropriate hard elements: Rock, logs or oyster reefs can be used to reduce wave and current energy reaching the shoreline and provide shelter for soft shore protection at sites with moderate exposure, severely impacted shoreline processes and/or a minimal available setback (refer to Johannessen et al., 2014 for more detail). Contractors must use locally sourced materials that match the composition of areas where rocky shorelines naturally occur near the project site. The goal is always to minimize the amount of rock used, limit the extent of hard elements, and never use vertical elements such as rock or cement walls, lock block, etc.

Bank re-sloping: This approach reduces the slope of an unstable bank, smooths out landslide scarps or other features that are particularly steep and unstable, facilitates vegetation establishment, and helps dissipate wave energy. The new slope should conform to the stable slope allowance as determined by a Qualified Coastal Professional. To be successful over time, re-sloping is immediately followed by intensive planting of native vegetation selected for high root strength, a variety of root types and depths, and suitability for site conditions. Re-sloping requires moving the bank crest landward to achieve a stable slope angle. This may not be feasible on small waterfront lots where there is insufficient room between the bank crest and major buildings, or space to move the buildings landward. Bank re-sloping is incompatible with bank swallow and other bank nesting species habitat.

Beach "nourishment" or "replenishment": A common means of soft shore protection in which sediment lost to erosion is replaced or augmented with imported sediment, often from an upland source, that resembles native beach substrate in both size and composition but may be slightly larger/coarser. Nearby, unimpacted shorelines that experience similar coastal processes can be used as a reference for sediment composition. Beach nourishment can protect beach resources by creating a larger sand or gravel reservoir, moving the shoreline seaward. In areas where sediment supply has been substantially reduced due to armoured bluffs, beach nourishment can mitigate the lost sediment supply and enable local beaches to resemble their historic size and sediment composition more closely. The *Marine Shoreline Design Guidelines* (Johannessen et al*.,* 2014 - see full reference under "Further Reading") devotes a chapter to beach nourishment (Chapter 7 - Technique 1), which provides insights on effects, cost, monitoring and maintenance. The 2021 USACE guidance document provides details regarding placement of material within the coastal zone and anticipated lifespan. While written for marine shorelines, there are still useful ideas for lake shorelines.

Beach nourishment with logs at Tyee Spit in Campbell River, British Columbia *Credit: P. Harrison.*

Breakwaters: Coast-parallel structures strategically placed inside or close to the surf-zone to protect the shore from wave action. Breakwaters typically constructed with rock and alter currents resulting in sediment accumulation in the lee of the structure. Careful consideration must be given to the placement, size, and orientation of breakwaters because they can create hazards for swimmers such as 'rip-currents' and dangerous eddies as well as disrupt sediment transport processes if not properly designed. Breakwaters can be used to protect vegetation and beach nourishment or encourage sediment accumulation and beach formation. Two types of breakwaters are most likely to be considered for a nature-based project:

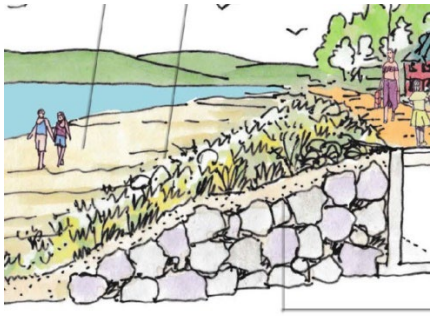
1. *Submerged Breakwater:* One or a series of structures whose crest(s) remains below water level at HHWLT. Can have a long slope on the seaward side to increase wave breaking action.
2. *Detached Beach Breakwater:* One or a series of breakwaters whose crests remain above water level at HHWLT. Short breakwaters are recommended as they are safest for swimmers and create the least disruption to transport processes (Mangor, 2013).

Buried bulkheads or revetments: A technique where the hard elements are buried below a substantial sloped soft surface of smaller diameter materials, that mimic the surrounding soft beach environment. For this type of design, the revetment should not be buried minimally with easily erodible materials that can be rapidly lost during storm events. The loss of the covering layer will convert these designs into exposed "hard armour" shorelines in the years following construction, and therefore would no longer qualify as a nature-based method. To prevent this, buried bulkheads or revetments must be designed by a Qualified Coastal Professional (see Glossary for definition) and should meet the following criteria:

1. The buried revetment should be intended only as additional protection against an extreme sequence of consecutive storm events that could excessively damage a soft shore between maintenance cycles.

2. The soft shore should be designed to cover hard elements for a minimum of ten (10) years without anticipated re-nourishment or maintenance for typical seasonal conditions.

Examples of buried revetments



Adapted from Town of Qualicum Beach Waterfront Master Plan, 2016. P.6.

From Zelo, I., H. Shipman and J. Brennan. 2000. Alternative Bank Protection Methods for Puget Sound Shorelines. Wash. Dept. Ecology Pub.# 00-06-012. P.57,58.

Drift sill: Low-profile groin structures perpendicular to the coast, designed to hold beach nourishment or constructed marsh material without significantly disrupting longshore transport. Drift sills are typically constructed from rock and to be considered supporting elements cannot rise above the level of the beach fill. They should also be designed to remain at the level of beach fill for a minimum of ten (10) years without anticipated re-nourishment or maintenance for typical seasonal conditions.

Large woody debris (LWD): Natural structural elements such as logs or stumps may be strategically placed in a natural orientation to add complexity and elevation to a nature-based project. Woody debris traps sediment can hold added beach material and provides some wind and wave buffering that protects plantings. In some cases, logs may be anchored to buried boulders or concrete blocks. Do NOT use creosoted or chemically treated woody debris in soft shore protection projects.

On marine sites, woody debris are typically only used above the higher high-water large tide (HHWLT) line to protect the area landward of the beach during storms at low to moderate wave energy sites. Logs have only been used successfully at lower elevations on the beach in low wave energy sites where fetch (distance over open water) is less than 2 miles, or 3.2 km. Some regions do not naturally have LWD as a part of the shoreline ecosystem, in these locations use of logs should be carefully considered and used only when absolutely necessary. Use of LWD in these locations is considered hybrid shore protection. Non-woody wrack material (e.g., seaweed, eelgrass) can also play a role in trapping and holding

sediment and providing nutrients in some systems. Generally, removing wrack, raking or other beach 'cleaning' activities are not recommended.

Living Breakwater: A structure that provides similar protective functions as a traditional breakwater except it is designed using natural ecosystem components (e.g., oyster or coral reefs). Living breakwaters are sometimes called artificial reefs because they provide opportunities for settlement and colonization by oysters or hard corals or use structural complexity to provide shelter and habitat for various marine and aquatic species. Reef balls, oyster castles, and bagged oyster shell are a few examples of materials commonly used to create living breakwaters. Careful consideration of coastal processes, environmental conditions, and local biology are critical for the success of living breakwater projects.

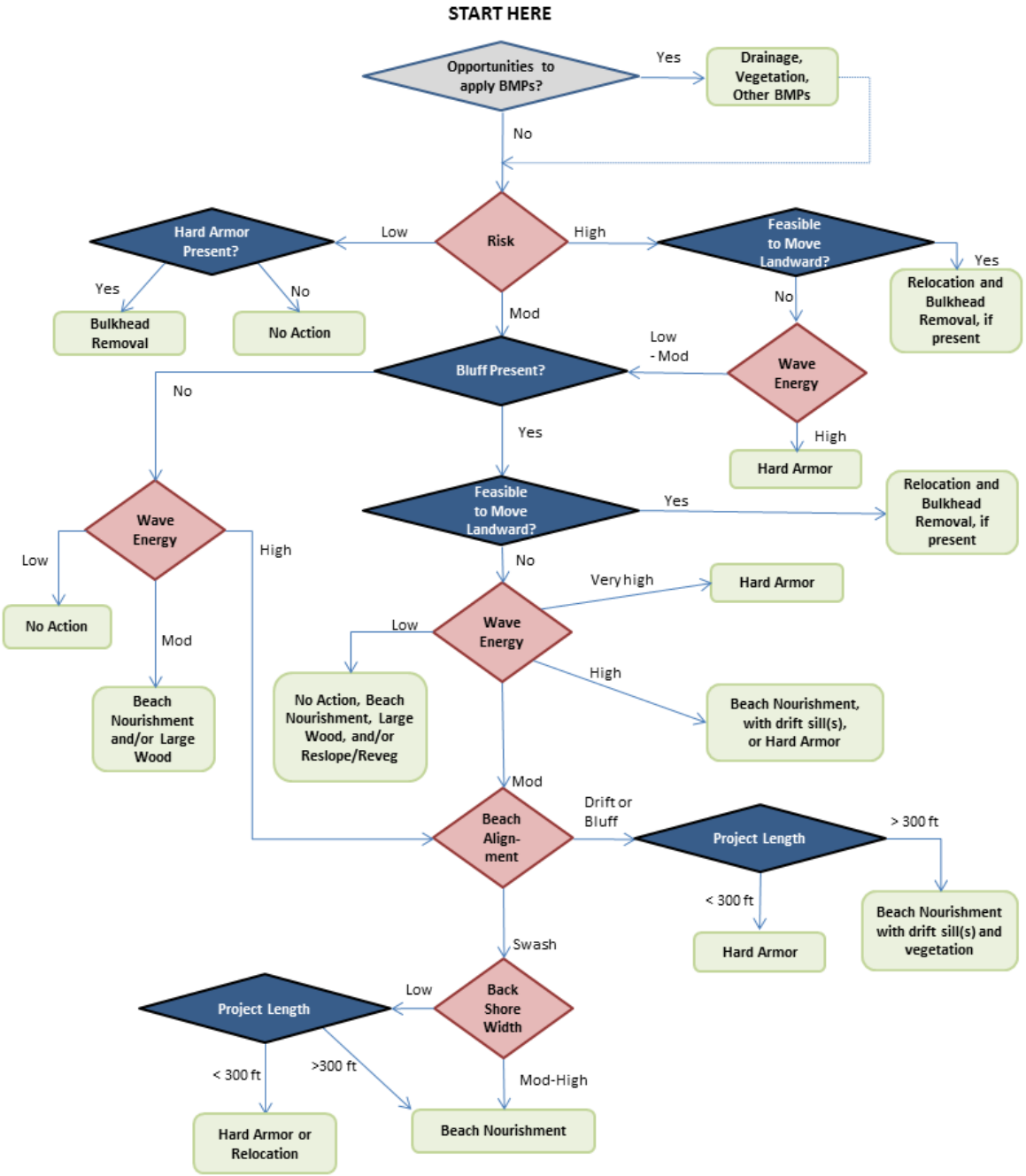
Living Dyke: The concept of the Living Dyke is a dyke (dike) with a long, low seaward slope intended to provide space for natural shoreline processes, while maintaining a relatively stationary shoreline position and providing flood protection (see SNC-Lavalin Inc., 2018). The long, low sloping seaward side of the Living Dyke helps dissipate wave energy which reduces the required crest height and reduces construction materials and total costs by up to 30%. The seaward slope also provides a suitable surface for the growth of wetland plants which preserves that ecological function of the coastal system and allows space for plant communities to migrate with sea level rise, partially alleviating the issue of 'coastal squeeze'.

***Marsh Sill*:** A low-profile, coast-parallel structure that is placed seaward of an eroding marsh or a newly built marsh, for the purpose of protecting the marsh from wave energy. Sills are commonly constructed from rock, coir fiber logs, or oyster shell. When constructing a new marsh, fill material is placed between the sill and the shoreline to create the marsh platform which is then planted with wetland plants. Appropriate fill material, slope grading, and plant species selection is critical for the success of a built marsh, as is an understanding of local tide levels, slopes, and wetland elevations. Consultation with a Qualified Environmental Professional is necessary for marsh creation projects to ensure the success of the plantings and functionality of habitat.

Vegetation: A critical component of soft shore protection in conjunction with other techniques. For marine sites, planting with salt-tolerant, native trees, shrubs, and perennials, and grasses is focused on the area immediately above the normally inundated beach and ideally extending into the upland. On low energy shores with fine-grained sediment, salt marsh vegetation can be installed or enhanced to reduce intermittent erosion, although this would typically not be a site that would require soft shore protection and would instead be considered enhancement. On lake shores, plantings can be a combination of planting native trees, shrubs, perennials and grasses above the normal water level and emergent vegetation at the water line. Planting submerged aquatic vegetation is not included in Green Shores certification, but, with the proper permits, could enhance habitat and dissipate wave energy.

Species selection should attempt to match the existing vegetation or the vegetation present at a similar, undisturbed site. Other considerations when choosing plants include light, aesthetics, and maintenance. If it is necessary to remove or bury existing vegetation as part of the shore protection, those areas must be replanted. Native planting may not be compatible with sensitive habitats (e.g., coastal barrens) or protected species (e.g., Piping Plover).

Appendix E: Decision Tree from Marine Shoreline Design Guidelines



Decision tree for identifying appropriate design techniques for a given site. Read top to bottom. (Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines.* Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. http://wdfw.wa.gov/publications/01583/) BMP = Best Management Practice.

Appendix F: Nature-Based Project Report Checklist

PROJECT REPORT

All boxes must be checked off

Provide a project report prepared by a Qualified Coastal Professional with experience in Coastal/Shoreline Engineering, confirming that the project site experiences erosion and/or that the project is intended to address flooding (storm surge, sea level rise, wave run-up) at the site and upland property. This report will include input from a Qualified Environmental Professional supporting design that restores or enhances fish and wildlife values.

Project report contents will:

- ☐ Be prepared by a **Qualified Coastal Professional** (P.Eng, P.Geo, or equivalent) with expertise in shoreline engineering, coastal geomorphology, or geotechnical engineering with experience in shoreline processes
- ☐ Defines incident sea state (wave characteristics) at project site; and design water levels (including clear allowances for components of tides, surge, and wave effects – if applicable)
- ☐ Provide an assessment of sediment transport processes at the site. In particular, coastal/shoreline sediment transport assessment and mapping based on aerial photo interpretation (existing and historical, if available), a site visit, and supporting technical analysis indicating:
  - Dominant and seasonal sediment transport pathways along shoreline adjacent to property and general area;
  - Sediment sources (streams, eroding bluffs, long shore transport) relevant to the littoral cell for the project; and
  - Sediment sinks or depositional areas that may be connected to the littoral cell for the project
- ☐ Provide before photos (i.e., existing conditions) showing the eroding shoreline prior to the project

Project report contents will include:

- ☐ Specifications for a nature-based protection design (e.g., no significant hard armour except to tie in with neighbouring property)
- ☐ Demonstration that the design allows for the continuation of natural processes such as longshore sediment transport AND riparian vegetation growth
- ☐ Demonstration that the design is based on analysis of erosion potential, wave energy and backshore width AND a demonstrated need:
  a) to protect existing permanent structures AND/OR
  b) to enhance degraded shore habitat that can be addressed by nature-based shoreline measures
- ☐ If a **Hybrid Design** is utilized (i.e., design that includes some hard shore elements such as rock structures, groins, revetments, and similar engineered structures along with soft

shore elements) the project report shall include the rationale for the inclusion of any such structures in design and how the design still meets other specifications noted above

- Note: buried revetments are typically used where there is a concern for rapid erosion. Such designs on eroding shorelines can become permanently exposed if there are not natural processes to re-nourish the beach at the structure (or a confirmed maintenance plan to re-nourish the project at regular intervals). If natural shoreline processes are not able to re-nourish the structure the hybrid design is likely not appropriate for consideration as a nature-based design

Appendix G-1: Plants for Pacific Lake Shorelines

The following is taken from *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington (pg.18-19),* published by the City of Seattle and available at www.seattle.gov/dpd/. For more information about appropriate shoreline plants, see the list of resources at the end of Appendix G-3.

Latin name	common name	exposure	moisture	height (ft.)
TREES				
Abies procera	noble fir	sun/part shade	dry/moist	200
Acer circinatum	vine maple	part shade/shade	dry/moist	25
Acer macrophyllum	bigleaf maple	sun/part shade	dry/moist	105
Alnus rubra	red alder	sun/part shade	moist/wet	70
Betula papyrifera	paper birch	sun	moist	80
Crataegus douglasii	black hawthorn	sun/part shade	dry/moist	25
Crataegus suksdorfii	Suksdorf's hawthorn	sun/part shade	dry/moist	20
Fraxinus latifolia	Oregon ash	sun/part shade	moist/wet	70
Malus fusca	Pacific crabapple	sun/part shade	dry/moist	40
Picea sitchensis	Sitka spruce	sun/part shade	dry/moist	200
Populus balsamifera	black cottonwood	sun	moist	100
Populus tremuloides	trembling aspen	sun	dry/moist	75
Pseudotsuga menziesii	Douglas fir	sun/part shade	dry/moist	200
Rhamnus purshiana	cascara	sun/part shade	dry/moist	30
Salix spp.	willow	sun/part shade	moist/wet	6-40
Thuja plicata	Western redcedar	part shade/shade	moist/wet	200
Tsuga heterophylla	Western hemlock	sun/part shade	dry/moist	180
GROUNDCOVER				
Achlys triphylla	vanilla leaf	part shade/shade	moist	1
Allium cernuum	nodding onion	sun	dry/moist	1
Asarum caudatum	wild ginger	part shade/shade	moist	0.5
Camassia quamash	common camas	sun/part shade	dry/moist	1
Cornus canadensis	bunchberry	part shade/shade	moist	0.5
Fragaria chiloensis	beach strawberry	sun/part shade	dry	1
Mahonia nervosa	low Oregon grape	sun/shade	dry/moist	2
Maianthemum dilatatum	false lily-of-the-valley	part shade/shade	dry/moist	1
Vancouveria hexandra	inside-out flower	part shade/shade	moist	1

Latin name	common name	exposure	moisture	height (ft.)
SHRUBS				
Amelanchier alnifolia	Saskatoon serviceberry	sun/shade	dry/moist	20
Andromeda polifolia	bog rosemary	sun/part shade	wet	1.5
Cornus stolonifera	red-osier dogwood	sun/shade	moist/wet	15
Corylus californica	beaked hazelnut	sun/shade	dry/moist	20
Gaultheria shallon	salal	part shade/shade	dry/moist	5
Holodiscus discolor	oceanspray	sun/shade	dry	15
Lonicera involucrata	black twinberry	sun/part shade	dry/wet	8
Mahonia aquifolium	tall Oregon grape	sun/shade	dry/moist	8
Philadelphus lewisii	mock-orange	sun/part shade	dry/moist	9
Physocarpus capitatus	Pacific ninebark	sun/shade	moist/wet	13
Rhododendron macrophyllum	Pacific rhododendron	part shade/shade	dry/moist	20
Ribes sanguineum	red-flowering currant	sun/part shade	dry/moist	6
Rosa gymnocarpa	bald-hip rose	sun/part shade	dry/moist	5
Rosa pisocarpa	cluster rose	sun/part shade	moist/wet	6
Rosa nutkana	nootka rose	sun/part shade	moist/wet	10
Rubus spectabilis	salmonberry	sun/shade	moist/wet	10
Salix scouleriana	Scouler willow	sun/part shade	moist/wet	25
Sambucus racemosa	red elderberry	sun/part shade	moist/wet	20
Sorbus sitchensis	Sitka mountain-ash	sun/part shade	moist	10
Spiraea douglasii*	spiraea	sun/part shade	moist/wet	12
Symphoricarpos albus	snowberry	sun/shade	dry/moist	5
Vaccinium ovatum	evergreen huckleberry	part shade	dry	12
Viburnum edule	highbush cranberry	sun/part shade	moist/wet	12
PERENNIALS				
Aruncus sylvester	goat's beard	sun/part shade	moist/wet	5
Aster subspicatus	Douglas' aster	sun/part shade	moist	2
Athyrium filix-femina	lady fern	sun/shade	moist/wet	4
Aquilegia formosa	Western columbine	sun/part shade	moist	2
Blechnum spicant	deer fern	part shade/shade	moist/wet	3
Carex canescens	grey sedge	sun/part shade	moist/wet	2
Dicentra formosa	Pacific bleeding heart	sun/part shade	moist/wet	1
Iris tenax	Oregon iris	sun/part shade	moist/wet	1
Lupinus polyphyllus	large-leaved lupine	sun	moist/wet	4
Mimulus guttatus	yellow monkey-flower	sun/shade	moist/wet	2
Polystichum munitum	sword fern	part shade/shade	moist	4
Sisyrinchium californicum	golden-eyed-grass	sun/part shade	moist/wet	1
Sisyrinchium idahoense	Idaho blue-eyed-grass	sun/part shade	moist/wet	2
Solidago canadensis	goldenrod	sun/part shade	dry/moist	4
Trillium ovatum	Western trillium	part shade/shade	moist/wet	1.5
EMERGENT AQUATIC PLANTS**				
Alisma plantago-aquatica	water-plantain	sun-part shade	wet	3
Carex kelloggii	Kellogg's sedge	sun/part shade	moist/wet	2
Carex obnupta	slough sedge	sun/part shade	moist/wet	3
Carex stipata	sawbeak sedge	sun/part shade	moist/wet	2
Sagittaria latifolia	arrowhead	sun/part shade	wet	3
Scirpus microcarpus	small-fruited bulrush	sun/part shade	wet	3
Scirpus acutus	hardstem bulrush	sun	wet	9
Typha latifolia*	cattail	sun/part shade	wet	8

Appendix G-2: Plants for Pacific Marine Shorelines

The following list is provided by Raincoast Applied Ecology, Vancouver, B.C. For more information about appropriate shoreline plants, see the list at the end of this section.

Recommended Native Trees, Shrubs, Grasses, and Forbs for Shoreline Sites in the Georgia Basin

Nick Page, Raincoast Applied Ecology (updated 2013)

Common Name	Scientific Name	Comments	Habitat[1]
Trees			
Douglas-fir	*Pseudotsuga menziesii*	Large tree for large sites only; prefers dry soils; fast growing once established	Marine riparian zone
Sitka spruce	*Picea sitchensis*	Large tree for large sites only; fast growing once established; some disease problems	Marine riparian zone
shore pine	*Pinus contorta*	Medium tree (<20 m); slow growing; dry sites with sandy soil	Marine riparian zone
red alder	*Alnus rubra*	Medium tree (<25 m); fast growing; not long lived.	Marine riparian zone
big-leaf maple	*Acer macrophyllum*	Large tree; fast growing once established; not long lived.	Marine riparian zone
Pacific willow	*Salix lucida*	Largest of the native willows (<25 m); too large for most bioengineering projects	Marine riparian zone
cascara	*Rhamnus purshiana*	Small tree with nice growth form and smooth, grey bark	Marine riparian zone
Hooker's willow	*Salix hookeriana*	Small tree willow with interesting leaves and catkins; relatively rare; good for bioengineering	Marine riparian zone
Douglas maple	*Acer douglasii*	Small tree; multiple stems; fast growing	Marine riparian zone
Scouler's willow	*Salix scouleriana*	Small tree willow (to 7 m); good for bioengineering	Marine riparian zone
Pacific crab apple	*Malus fusca*	Small tree (<10 m) or large shrub; thicket-like; white spring flowers; small apple-like fruits	Marine riparian zone
Shrubs			
Nootka rose	*Rosa nutkana*	Good for shrub thickets; pink summer flowers and winter colour (hips); some wildlife value	Marine riparian zone
oceanspray	*Holodiscus discolor*	Tall shrub; tolerant of dry, coastal sites; relatively drab colour with subtle flowers	Marine riparian zone
red flowering currant	*Ribes sanguineum*	Medium shrub; excellent spring flower colour; some problems with disease; good for hummingbirds	Marine riparian zone
snowberry	*Syphoricarpus albus*	Medium shrub; good tolerance of dry sites; well developed roots; winter colour	Marine riparian zone
mock-orange	*Philadelphus lewisii*	Tall shrub; native to coastal sites in BC; good flower colour but otherwise subtle	Marine riparian zone
sweet gale	*Myrica californica*	Not native to Georgia Basin; evergreen shrub (to 7 m); slow growth; dense branches and leaves	Marine riparian zone
salal	*Gaultheria shallon*	Slow growing low shrub; difficult to establish; not recommended for active use areas	Marine riparian zone
Oregon-grape	*Mahonia nervosa*	Slow growing low shrub; difficult to establish; not recommended for most sites	Marine riparian zone
thimbleberry	*Rubus parviflorus*	Medium shrub; fast growth; white summer flowers; red thimble-like berries; better than salmonberry	Marine riparian zone
salmonberry	*Rubus spectabilis*	Medium shrub; fast growth; white summer flowers; no winter colour; berry producer	Marine riparian zone
Indian-plum	*Oemelaria cerasiformis*	Medium shrub; early spring leaves and flowers; prefers moist sites	Marine riparian zone
black twinberry	*Lonicera involucrata*	Medium shrub; subtle yellow flowers; red-black berries; will grow from cuttings; straggly when older	Marine riparian zone
kinnickinnick	*Arctostaphylos uva-ursi*	Low shrub/groundcover; slow growing; evergreen with red berries; tolerant of dry sites	Marine riparian zone
Pacific ninebark	*Physocarpus capitatus*	Tall shrub (<4 m) with dense branches; white rounded flower clusters; open, moist beaches	Marine riparian zone
Grasses			
beach wild-rye grass	*Leymus mollis* ssp. *mollis*	Dominant native beach grass in BC; blue-green leaves; establishes from sprigs/rhizomes	upper beach
red fescue	*Festuca rubra*	Common native grass in upper beach meadows; clumping with taller flowers	Marine riparian zone
Forbs / Wildflowers			
entire-leaved gumweed	*Grindelia integrifolia*	Yellow, daisy-like flower with resinous heads; rubbery leaves; deep tap root; establishes from seeds	upper beach
large-leaved lupine	*Lupinus polyphyllus*	Large native lupine; purple flowers; tolerant of poor soils; to 1 m tall with flowers; can be "scruffy"	Marine riparian zone
seashore lupine	*Lupinus littoralis*	Low growing native beach lupine; light purple flowers; fuzzy leaves and stems; grows in sandy soils	upper beach
beach pea	*Lathyrus japonicus*	Often occurs with beach wild-rye; purple flowers; spreads through rhizomes; sandy sites	upper beach
silvery burweed	*Ambrosia chamissonis*	Clump or mound forming perennial; low; bisected silvery leaves; sublte flowers in late summer	upper beach
beach strawberry	*Rubus chiloensis*	Native strawberry; white flowers; spreads from runners; low groundcover; tolerant of poor soils	upper beach
sea-watch	*Angelica lucida*	Tall plant in the carrot family with white umbrella flowers and large seeds; common on moist beaches	upper beach
cow-parsnip	*Heracleum maximum*	Large native forb with tall, white umbrella flowers; sap causes dermatitis	Marine riparian zone
Cooley's hedge-nettle	*Stachys cooleyae*	Perennial from rhizomes; purple-red flowers; moist upper beach; good for hummingbirds	Marine riparian zone
common yarrow	*Achillea millefolium*	White, long-lived flower; common in beach meadows and estuaries	Marine riparian zone
wooly sunflower	*Eriophyllum lanatum*	yellow, daisy-like flower with silvery foliage; drought tolerant; native to coastal bluffs and meadows	Marine riparian zone

[1]The marine riparian zone supports a mix of trees, shrubs, grasses and forbs. Disturbance from shoreline processes such as wave erosion is rare. The upper beach (which is lower or seaward of the marine riparian zone) is the zone of frequent (annual) disturbance from waves, high tides, wood debris, and salt spray. It only supports plants tolerant of this kind of disturbance, with beach wild-rye grass dominant on most sites. Woody plants do not grow in the upper beach.

Appendix G-3: Plants for Atlantic Lake Shorelines

Scientific Name	Common Name	Exposure	Moisture	Comments
TREES				
Acer rubrum	red maple	full/partial sun	moist/wet	swamps, riparian zones, lakeshores
Betula cordifolia	heart-leaved birch	full sun	moist/dry	riparian zones, lakeshores
Betula papyrifera	paper birch	full sun	moist/dry	riparian zones, lakeshores
Fraxinus americana	white ash	full/partial sun	moist/dry	riparian zones, river floodplains
Ostrya virginaiana	ironwood	full/partial sun	moist	river floodplains, lakeshores
Picea glauca	white spruce	full sun	moist/dry	tolerant of salt spray, dunes
Picea rubens	red spruce	full/partial sun	moist/dry	lakeshores
Picea mariana	Black spruce	full/partial sun	moist/dry	tolerant of salt spray, dunes
Populus balsamifera	balsam poplar	full sun	moist/dry	lakeshores, riparian zones
Populus gradidentata	large-tooth aspen	full sun	moist/dry	lakeshores, riparian zones
Populus tremuloides	trembling aspen	full sun	moist/dry	lakeshores, riparian zones
Salix spp.	willows	full sun	wet/moist/dry	lakeshores, riparian zones, freshwater wetlands
Thuja occidentalks	eastern white cedar	full/partial sun	wet/moist/dry	lakeshores, freshwater wetlands
SHRUBS				
Alnus incana	speckled alder	full/partial sun	moist/wet	lakeshores, riparian zones, freshwater wetlands
Chamaedaphne caliculata	Leatherleaf	full sun	wet	lakeshores, freshwater wetlands
Cornus sericea	red osier dogwood	full/partial sun	moist	lakeshores, swamps
Gaylussacia baccata	black huckleberry	full sun	moist/dry	lakeshores
Ilex verticilata	common winterberry	full sun	moist	lakeshores, freshwater wetlands
Morella pensylvanica	northern bayberry	full sun	moist	lakeshores
Myrica gale	sweet gale	full sun	moist	lakeshores, freshwater wetlands
Rhododendron canadense	rhodora	full sun	moist	lakeshores, freshwater wetlands
Salix spp.	willow	full sun	moist/wet	lakeshores, freshwater wetlands
Spireaea spp.	meadowsweet/steeplebush	full sun	moist/wet	lakeshores, freshwater wetlands
Viburnum nudum	wild raisin	full/partial sun	moist	lakeshores/riparian zones
GRAMINOIDS and FORBS				
Acorus americana	American sweetflag	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Alisma triviale	northern water plantain	full/partial sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Asclepias incarnata	swamp milkweed	full sun	moist	upper edges of freshwater wetlands, lakeshores
Bidens spp.	beggarticks	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Calamagrostis canadensis	bluejoing reed grass	full sun	moist/wet	lakeshores, freshwater wetlands
Calla palustris	wild calla	full/partial sun	wet	freshwater wetlands
Caltha palustris	marsh marigold	full/partial sun	wet	lakeshores, freshwater wetlands, riparian zones
Carex spp.	sedges	full/partial sun	wet/moist/dry	lakeshores, freshwater wetlands
Chelone glabra	white turtlehead	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Claytosmunda claytoniana	interrupted fern	partial sun/shade	moist	shaded riparian zones, floodplains
Comarum palustre	marsh cinquefoil	full sun	wet	lakeshores, freshwater wetlands
Dulichium arundiaceum	three-way sedge	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Eleocharis spp.	spikerush	full/partial sun	wet/moist	lakeshores, freshwater wetlands
Elymus virginicus	Virginia wild rye	full sun	moist	lakeshores, riparian zones
Eriocaulon aquaticum	white buttons	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Eriophorum spp.	cottongrass	full sun	wet	lakeshores, freshwater wetlands
Euthamia caroliniana/graminifolia	grass-leaved goldenrod	full/partial sun	moist	lakeshores
Glyceria spp.	manna grass	full/partial sun	moist/wet	lakeshores, freshwater wetlands, riparian zones
Gratiola lutea	golden hedge-hyssop	full sun	moist	lakeshores
Hydrocotyle americana	American marsh pennywort	full/partial sun	wet	emergent aquatic
Hypericum boreale, canadense	St John's-wort	full/partial sun	moist	lakeshores
Impatiens capensis	spotted jewelweed	partial sun/shade	moist	stream edges, lakeshores; annual
Iris versicolor	blue flag	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Juncus spp.	rushes	full sun	moist/wet	lakeshores, freshwater wetlands
Lobelia dortmanna	water lobelia	full/partial sun	wet	emergent aquatic
Lycopus americanus/uniflorus	water horehound	full sun	wet	lakeshores
Lysimachia spp.	yellow loosestrife	full/partial sun	moist/wet	lakeshores
Matteuccia struthopteris	ostrich fern	partial sun/shade	moist	shaded riparian zones, floodplains
Mimulus ringens	monkeyflower	full sun	moist/wet	lakeshores, freshwater wetlands
Oclemena nemoralis	bog aster	full sun	moist/wet	lakeshores
Onoclea sensibilis	sensitive fern	partial sun/shade	moist	shaded riparian zones, floodplains
Osmunda regalis	royal fern	partial sun/shade	moist/wet	lakeshores, freshwater wetlands
Osmundastrum cinnamomeum	cinnamon fern	partial sun/shade	moist/wet	shaded riparian zones, floodplains, coastal barrens
Persicaria lapathifolia	pale smartweed	full sun	moist/dry	upper edges of freshwater wetlands, lakeshores
Persicaria sagittata	arrow-leaved smartweed	full sun	moist	upper edges of freshwater wetlands, lakeshores
Pontederia cordata	pickerelweed	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Potentilla anserina	common silverweed	full sun	moist	upper edges of freshwater wetlands, lakeshores
Ranunculus flammula	lesser spearwort	full sun	moist	lakeshores
Rorippa palustris	bog yellowcress	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Rosa vinginiana	virginia rose	full sun	moist/dry	lakeshores, freshwater wetlands
Rubus hispidus	bristly dewberry	full/partial sun	moist/dry	lakeshores
Rubus pubescens	dwarf red raspberry	full/partial sun	moist	lakeshores, riparian zones
Sagittaria spp.	arrowhead	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic

Scirpus spp.	bulrush	full sun	wet	lakeshores, freshwater wetlands
Scutellaria galericulata/lateriflora	skullcap	full/partial sun	moist/wet	lakeshores, freshwater wetlands
Sisyrinchium montanum	blue-eyed grass	sun	dry/moist	lakeshores, freshwater wetlands, riparian zones
Sparganium spp.	bur-reed	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Typha spp.	cattail	full sun	wet	lakeshores, freshwater wetlands; emergent aquatic
Viola lanceolata	lance-leaved violet	full sun	moist/dry	lakeshores
Xanthium strumarium	cocklebur	full sun	moist/dry	beaches, dunes
Xyris spp.	yellow-eyed grass	full sun	moist/wet	lakeshores, freshwater wetlands

Other sources of information about plants for marine and freshwater shores

Adams, M.A. 2002. *Shoreline Structures Environmental Design: a Guide for Structures along estuaries and large rivers.* Stewardship Series www.stewardshipcentrebc.ca/bc-stewardship-series/ contains a chapter on methods for successfully establishing vegetation and an illustrated Appendix of common riparian plants (mostly freshwater).

Washington State University Beach Watchers EZ-ID Guides - Shoreline Plants www.beachwatchers.wsu.edu/ezidweb/ Extensive and easy-to-use guide to marine shoreline plants.

Washington Native Plant Society www.wnps.org Information on where to purchase native plants in Washington State, plus so much more about using native plants at home.

BC Native Plant Society www.npsbc.ca/nativegardening.html Information on where to purchase native plants in British Columbia plus so much more about using native plants at home.

Washington State Department of Ecology. Slope Stabilization and Erosion Control - role of vegetation. www.ecy.wa.gov/programs/sea/pubs/93-30/using01.html and Plant Selection Guide www.ecy.wa.gov/programs/sea/pubs/93-30/table3.html. Guidance on plants particularly well suited to stabilizing shoreline banks and bluffs.

Appendix G-4: Plants for Atlantic Marine Shorelines

Scienctific name	Common name	exposure	moisture	comments
TREES				
Picea mariana	black spruce	full/partial sun	moist/dry	tolerant of salt spray, dunes
Picea glauca	**white spruce**	**full sun**	**moist/dry**	**tolerant of salt spray, dunes**
SHRUBS				
Morella pensylvanica	northern bayberry	full sun	moist	dunes, edges of salt marshes
Rosa virginiana	**virginia rose**	**full sun**	**moist/dry**	**dunes, edges of salt marshes**
Rubus hispidus	bristly dewberry	full/partial sun	moist/dry	dunes, edges of salt marshes
Rubus idaeus	**raspberry**	**full sun**	**moist/dry**	**dunes, edges of salt marshes**
Vaccinium macrocarpon	cranberry	full sun	moist	coastal banks
Spirea alba	**white meadowsweet**	**full sun**	**moist/dry**	**coastal banks**
Empetrum spp.	crowberry	full sun	moist/dry	dunes, barrens, coastal banks
GRAMINOIDS and FORBS				
Achllea borealis	northern yarrow	full sun	moist/dry	dunes
Ammophila breviligulata	**american beach grass**	**full sun**	**moist/dry**	**beaches, dunes**
Angelica spp.	purple-stemmed angelica	full sun	moist	rocky shorelines
Anthoxanthum nitens	**sweetgrass**	**full sun**	**moist**	**shorelines**
Bolboschoenus maritimus	saltmarsh bulrush	full sun	wet	salt marshes
Atriplex spp.	**orache or saltbush**	**full sun**	**moist/dry**	**salt marshes, mud flats**
Cakile edetula	American searocket	full sun	moist/dry	front of dunes); annual
Calystegia sepium	**hedge false bindweed**	**full/partial sun**	**moist/dry**	**of salt marshes**
Distichlis spicata	salt grass	full sun	moist/wet	salt marshes
Festuca rubra	**red fescue**	**full sun**	**moist**	**shorelines**
Halerpestes cymbalaria	seaside buttercup	full sun	moist	salt marshes
Honckenya peploides	**seabeach sandwort**	**full sun**	**moist/dry**	**beaches, dunes, salt marshes**
Iris versicolor	blue flag	full/partial sun	moist/wet	rocky shorelines
Juncus balticus	**baltic rush**	**full sun**	**moist/wet**	**salt marshes, rocky shorelines**
Juncus gerardii	black grass	full sun	moist/wet	salt marshes, rocky shorelines
Lathyrus japonicus	**beach pea**	**full sun**	**moist/dry**	**beaches, dunes**
Leymus mollis	sea lyme grass	full sun	moist/dry	beaches, dunes
Ligusticum scoticum	**Scotch lovage**	**full sun**	**moist/dry**	**of salt marshes, rocky**
Limonium carolinianum	sea lavender	full sun	moist	salt marshes
Lysimachia maritima	**sea milkwort**	**full sun**	**moist/wet**	**salt marshes**
Maianthemum stellatum	starry false Solomon's seal	full/partial sun	moist/dry	dunes
Mertensia maritima	**sea lungwort**	**full sun**	**moist/dry**	**beaches, dunes**
Oenothera biennis	evening primrose	full sun	moist/dry	beaches, dunes
Plantago maritima	**seaside plantain**	**full sun**	**moist/dry**	**salt marshes, rocky shorelines**
Potentilla anserina	common silverweed	full sun	moist	salt marshes
Salcornia spp.	**glasswort, crowsfoot, pickleweed**	**full sun**	**moist/dry**	**salt marshes, mud flats**
Solidago sempervirens	seaside goldenrod	full sun	moist/dry	beaches, dunes, salt marshes
Spergularia canadensis/salina	**sandspurrey**	**full sun**	**moist/dry**	**salt marshes, mud flats**
Sporobolus alterniflorus	smooth cordgrass	full sun	wet	salt marshes, mud flats
Sporobolus michauxianus	**prairie cordgrass**	**full sun**	**wet/moist**	**salt marshes**
Sporobolus pumilus	saltmeadow cordgrass	full sun	wet	salt marshes
Suaeda spp.	**sea-blite**	**full sun**	**moist/dry**	**salt marshes, mud flats**
Symphyotrichum novi-belgii	New York aster	full/partial sun	moist/dry	of salt marshes
Trglochin spp.	**arrowgrass**	**full sun**	**moist/wet**	**salt marshes**
Xanthium strumarium	cocklebur	full sun	moist/dry	beaches, dunes

Appendix H: Landscape Maintenance Checklist

Best Practices for landscape maintenance are for areas with no critical, sensitive, or migratory bird habitat identified. If critical, sensitive, or migratory bird habitat is identified on your property, you must take extra steps to ensure that maintenance does not constitute activities that are likely to destroy critical habitat. Refer to the recovery strategy for the species identified on your property for which activities are likely to destroy critical habitat.

	Maintaining Trees, Shrubs & Lawns	Additional Information
Gardening Best Practices	Indicate which of the following Maintenance Best Practices you use: ☐ Aerate (core) lawn areas annually ☐ Let grass clippings fall in place ☐ Dry out plants between watering ☐ Apply 1-2 inches of composted mulch to planted areas annually ☐ Hand weed planter beds/pots ☐ Relocate or replace plants requiring high maintenance/water inputs (i.e.: use plants adapted to your garden's climate and soils) ☐ Fertilize only when required	Aeration of turf reduces compaction and increases air, nutrient and water movement into the soil. By increasing water infiltration, runoff and erosion can be reduced. Letting grass clippings fall in place cycles nutrients. Drying out plants between watering promotes healthy rooting. Relocating plants to sites with optimal conditions for that species can help reduce maintenance inputs (right plant - right place). Also, plants that are adapted to your garden's conditions (i.e.: native plants) reduce watering and general maintenance needs.
Product Selection	Indicate which of the following Maintenance Products you use (or plan to use): ☐ Local organic fertilizers (compost, composted manure, etc.) ☐ Organic 'processed' fertilizers (bone meal, fish compost, blood meal, etc.) ☐ Slow-Release Nitrogen fertilizers ☐ Electric, cordless electric or push-reel (non-gas powered) mower	Avoiding the use of chemical or synthetic fertilizers can dramatically reduce the amount of nutrients delivered to shorelines and receiving water bodies. It also reduces demand for non-renewable resources that are used to manufacture synthetic fertilizers. Using human-powered tool helps improve urban air quality and reduces noise pollution.
	Pest Management	**Additional Information**
Gardening Best Practices	Indicate which of the following Pest Management Best Practices you use (or plan to use): ☐ Hand removal or pruning out of pests and disease ☐ Pest traps (slug traps, or tanglefoot on tree trunks, etc.) ☐ Barriers to pest movement (copper strips to stop slugs; mesh netting for birds, etc.)	Simple gardening techniques can go a long way to reducing pest problems in the average garden. Spending time in your yard to identify pests or disease occurrences early, and then remove them manually before they become an infestation is often the least expensive and most effective strategy for pest management.

Product Selection	Indicate which of the following Pest Control Products you use (or plan to use): ☐ Horticultural oils, soaps or minerals (e.g., sulphur, baking soda, iron phosphate, horticultural oil, etc.) ☐ Bio-controls (i.e.: Bt, predatory nematodes, or beneficial insects, etc.) ☐ Botanicals (e.g., neem oil, pyrethrum, etc.) *NOTE: Use these pesticides only as a last resort!*	Avoiding the use of synthetic and poisonous substances in your garden reduces health risks to humans, and it also prevents the removal of beneficial insects. Typically, poisons and chemical sprays will kill not only the pest, but also insects that feed on the pests or insects that provide other 'services' to your garden (pollinators, spiders, ladybugs, etc.).

Appendix I: Onsite Sewage System Maintenance Plan

Maintenance Plan and Schedule

This monitoring section should be completed three years after construction to ensure the proper function of the septic system.

Please answer the following questions if there is an onsite sewage treatment system (e.g. septic tank) on the property:

When was the septic system last checked/pumped by a qualified professional?
_____ (YYYY-MM-DD)

Next anticipated check? _____ (YYYY-MM-DD)

*Note: we recommend the septic system to be pumped out by a license contractor every 3-5 years (Shoreline Property Resources, n.d.).

Complete the following checklist of your septic system.

OSS Maintenance Plan Checklist

Requirement Met?	Requirements	Information
Y / N	❑ Note the following: o All tank access points, dispersal, and outfall locations if applicable. o Type of OSS (i.e., contour, peat, approved alternatives) o Size/capacity of OSS ❑ Recommended pumping schedule ❑ List contact information for: septic hauler; inspector; and agency/department to report system malfunctions or possible release of untreated sewage to environment ❑ Note any issues or malfunctions such as backups, odours and/or pooling water)	
Y / N	Best Management Practices in maintenance plan: ❑ Avoid pouring or flushing into the septic system the following: oil, grease, disinfectants (kills the bacteria within the system), solvents, paints, caustic cleaners,	For further information on Onsite Sewage

	cigarette butts, sanitary supplies, diapers, condoms, tissues, napkins, tea leaves, coffee grounds, and fats. These contaminants can all plug a septic tank, treatment components, dispersal field, or harm the biological processes in the treatment system ❑ Protect the system from physical damage, for example, o no vehicle traffic over the system components including the dispersal field, o do not alter the substrate or cover the dispersal field with textile or plastic liner (the dispersal field requires oxygen), o do not plant trees or shrubs over or within proximity of the dispersal field (the roots can damage the integrity of the dispersal field and cause short circuiting) ❑ Do not use septic system additives ❑ Do not allow roof or foundation drains, sump pumps, or other surface water sources to discharge into the onsite sewage system ❑ Do not hydraulically overload the system; for example, running toilets, leaky faucets, etc. ❑ Do not irrigate or water the dispersal field or near tanks ❑ Do not install a garburator ❑ Do not discharge drinking water treatment systems backwash (water softeners, filter media recharge) to the onsite system ❑ Mitigate excessive surface water and inflow from rain runoff. This can be achieved by grading the property to avoid surface water pooling or installing interceptor trenches to divert stormwater around the dispersal field	System see Credit 3.6.
	❑ If it is a new/replaced/relocated, provide documentation signed by a qualified inspector or appropriate authority that the system meets the current standards/regulations in your local jurisdiction for distance (setback) from the shoreline,	

	or a minimum 15 m/50 ft from the ordinary high-water mark (OHWM), whichever is greater	

Appendix J: Advisory Committees

Green Shores for Homes (GSH) 2021-2023 Leads

Norah Bonsteel, Kirsten Ellis, Caytlyn McFadden, Danika van Proosdij
Saint Mary's University | TransCoastal Adaptations Centre for Nature-Based Solutions

DG Blair
Stewardship Centre for BC

GSH 2021-2023 Contributors:

Camila Fisher, Saint Mary's University | TransCoastal Adaptations
Kelly Loch, Stewardship Centre for British Columbia
Jenna Miller, Saint Mary's University | TransCoastal Adaptations
Kelly Umlah, Saint Mary's University | TransCoastal Adaptations
Jane Heeney, Saint Mary's University | TransCoastal Adaptations

GSH 2021-2023 Pilot Project Contributors

- Colin Gray, Mersey Tobeatic Research Institute (MTRI)
- Hannah Schriber, University of Victoria
- Izzy Clarke, Coastal Action
- Kelly Loch, Stewardship Centre for British Columbia
- Sam Battaglia, Coastal Action

GSH 2021-2023 Credit 2.1 Working Group

- Colin Gray, MTRI
- Ian Bryson, NSECC
- Jeremy Lundholm, Saint Mary's University | TransCoastal Adaptations | CBWES Inc.
- Kym Welstead, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
- Lesley Farrow, Canadian Wildlife Service, Environment and Climate Change Canada
- Nicole McDonald, CBCL Ltd.
- Samara Eaton, Canadian Wildlife Service, Environment and Climate Change Canada
- Sarah Robinson, CBCL Ltd.
- Suzanne Earle, Department of Fisheries and Oceans Canada

GSH 2021-2023 Credit 1.5 Working Group

- Grant Lamont, Northwest Hydraulic Consultants, Ltd
- Harriet Rueggeberg, Green Shores Technical Advisory Committee
- Nicole Faghin, Washington Sea Grant
- Paul de Greeff, Murdorch de Greeff Landscape Architects
- Victoria Fernandez, CBCL Ltd.

Appendices

GSH 2021-2023 Technical Advisory Committee

- Brian Emmett, Green Shores Technical Advisory Committee
- Dan Nickel, The Watershed Company
- Danker Kolijn, DHI
- Dave Harper, British Columbia Institute of Technology
- Derek Ray, Northwest Hydraulic Consultants
- Gabby Mauti, CBCL
- Grant Lamont, Northwest Hydraulic Consultants Ltd.
- Harriet Rueggeberg, Green Shores Technical Advisory Committee
- Jeffie McNeil, MTRI
- Jessica Côté, Blue Coast Engineering
- Joanna Eyquem, Intact Centre on Climate Adaptation
- Kelly Loch, Stewardship Centre for British Columbia
- Kyla Milne, NSECC
- Margaret Glowacki, City of Seattle
- Megan Turnock, LEES & Associates Landscape Architects
- Molly Tomlik, Environment and Climate Change Canada
- Nancy Anningson, Halifax Regional Municipality
- Nicole Faghin, Washington Sea Grant
- Patricia Manuel, Dalhousie University
- Paul de Greeff, Murdoch de Greeff Landscape Architects
- Rosmarie Lohnes, Helping Nature Heal
- Sabine Dietz, CLIMAtlantic
- Samantha Battaglia, Coastal Action
- Tasmin Lyle, Ebbwater Consulting
- Tony Bowron, CBWES Inc.
- Victoria Fernandez, CBCL

GSH Steering Committee 2015

- Brian Emmett, Archipelago Marine Research
- David Marlor, Islands Trust
- DG Blair, Stewardship Centre for BC
- Gretchen Harlow, Stewardship Centre for BC
- Harriet Rueggeberg, H.Rueggeberg and Assoc.
- Linda Lyshall, San Juan County
- Maggie Glowacki, City of Seattle
- Nicole Faghin, Washington Sea Grant
- Susan Key, San Juan County

GSH Technical Team 2015

- Adrian Rowland, KAPMAR Consulting
- Andrea MacLennan, Coastal Geologic Services
- Jim Brennan, J A Brennan and Associates
- Jim Johannessen, Coastal Geologic Services
- John Readshaw, SNC Lavalin
- Jose Carrasquero, Herrera Environmenta
- Peter Kilpatrick, Ravenhill Construction
- Peter Sundberg, City Green
- Scott Murdoch, Murdoch deGreef Design
- Wendy Gerstel, Qwg Applied Geology

GSH Advisors 2015

- Jim Brennan, Washington Sea Grant
- Spencer Reeder, Cascadia Consulting Group
- Hugh Shipman, Washington Dept. of Ecology

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- Colleen & John Mercer, University of Ottawa, Ontario and ICURA C-change
- Joe Burcar, Washington State Dept. of Ecology
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- Laura Arber and Christa Heller, Washington Dept. of Fish and Wildlife
- Michelle Bigg, Fisheries & Oceans Canada (Department of Fisheries and Oceans)
- Paul Cereghino, NOAA
- Peter Hummel, Anchor QEA, WA
- Sheila Richardson, BC Ministry of Environment
- Terri Martin, Kevin Brooks and Chris Osborne, City of Campbell River, BC

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Washington,
British Columbia and
Maritime Provinces