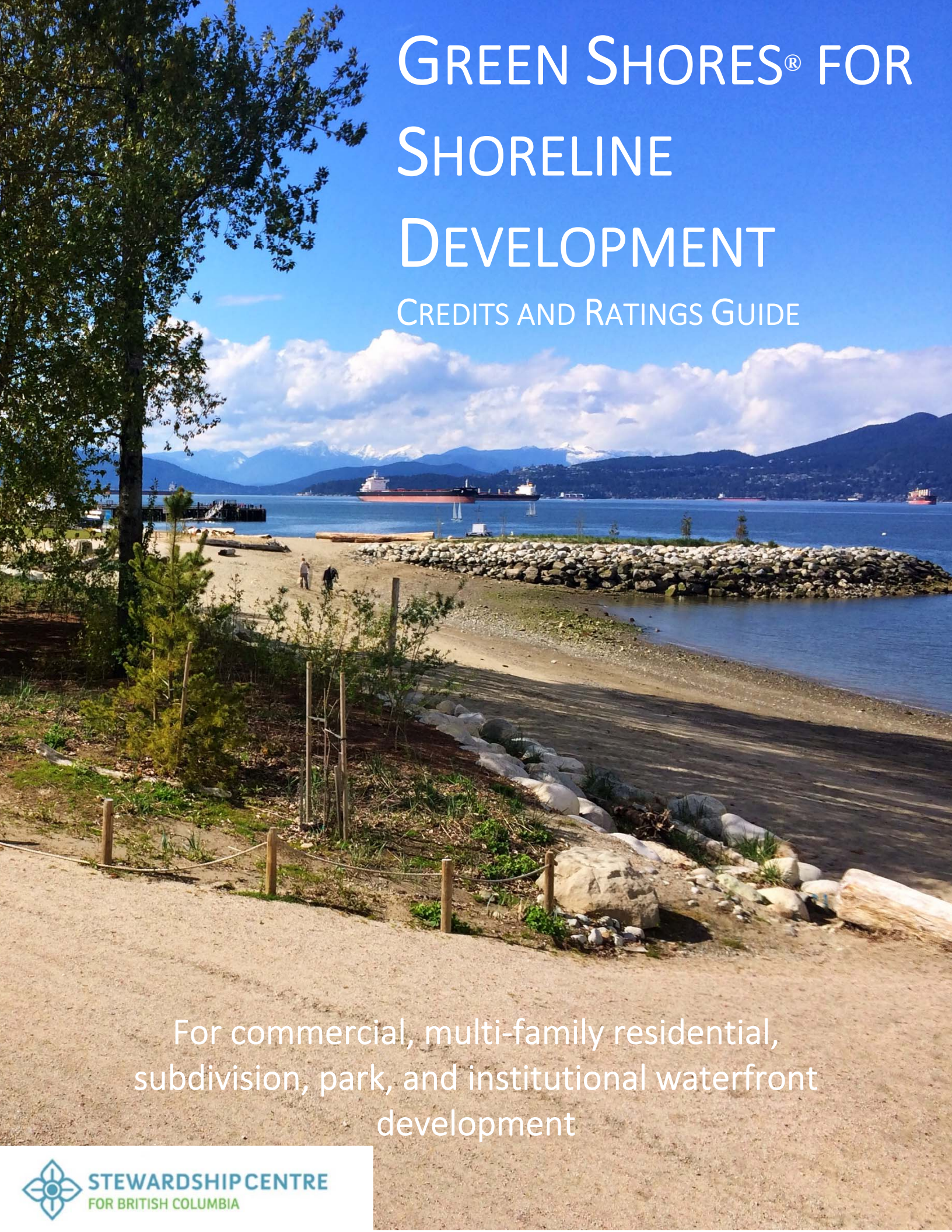

Green Shores® for Shoreline Development

Credits and Ratings Guide

For commercial, multi-family residential, subdivision, park, and institutional waterfront development

STEWARDSHIP CENTRE
FOR BRITISH COLUMBIA

For more information regarding Green Shores contact:

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STEWARDSHIP CENTRE
FOR BRITISH COLUMBIA

Cover photo: Jericho Beach Restoration, a Green Shores “Gold” project, City of Vancouver, BC.
Photo credit: Nick Page

GREEN SHORES FOR SHORELINE DEVELOPMENT

CREDITS AND RATINGS GUIDE

A REFERENCE TO MINIMIZE THE ENVIRONMENTAL IMPACT OF WATERFRONT PROPERTIES AND DEVELOPMENT

UPDATED 2020 BY COASTAL GEOLOGIC SERVICES INC. FOR THE STEWARDSHIP CENTRE FOR BRITISH COLUMBIA

www.stewardshipcentrebc.ca/Green_shores

GREEN SHORES IS A PROGRAM OF THE
STEWARDSHIP CENTRE FOR BRITISH COLUMBIA

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Contents

People love to live, work and play in places where water and land meet. Shorelines provide work, recreation, living space, mild climates and wonderful views.

Unfortunately, many of the natural features that make shorelines so attractive are often the casualties of human activities. Native trees, shrubs, and grasses are cleared to make way for development 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 people are finding new strategies for protecting waterfront properties while also protecting and restoring habitats. Instead of concrete and sheet pile, these practices use a combination of plantings, gravel and sand, logs, stones, setbacks, and slope modification to protect against shoreline erosion and provide access while respecting the ecological attributes of the shoreline.

(Adapted from Green Shorelines, City of Seattle, 2011).

Green Shores for Shoreline Development "Gold" project: New Brighton Park shoreline restoration, Vancouver, BC. (Port of Vancouver).

Introduction

Green Shores® is an initiative of the Stewardship Centre for BC (SCBC). The program promotes sustainable shoreline ecosystems for commercial, residential, institutional and park properties. It supports a broader vision for Canada's waterfront communities to increase capacity to minimize impacts of shoreline development and climate change while preserving or enhancing shoreline ecology and ecosystem services. Climate change is expected to impact the rate and nature of change across Canada's shorelines and affect its ecosystems. Green Shores incentivizes and provides a guideline for climate change adaptation and incorporates the most recent estimates of sea level rise[1] to increase shoreline resilience for both ecosystems and property developments.

The Green Shores guiding principles are to:

1. Preserve the integrity and connectivity of shoreline processes;
2. Maintain and enhance shoreline habitat diversity and function;
3. Minimize and reduce pollutants to the shoreline environment;
4. Reduce and reverse cumulative impacts to shoreline systems.

Benefits of the Green Shores approach:

- Enhanced shorelines with native vegetation, wildlife habitat, and improved access to waterfront activities
- Increased resilience of shorelines against erosion and flooding using alternatives to costly sea and lakeshore retaining walls while addressing owner concerns
- Wide range of benefits compatible with LEED for Homes, BuiltGreen, and Sustainable Sites programs

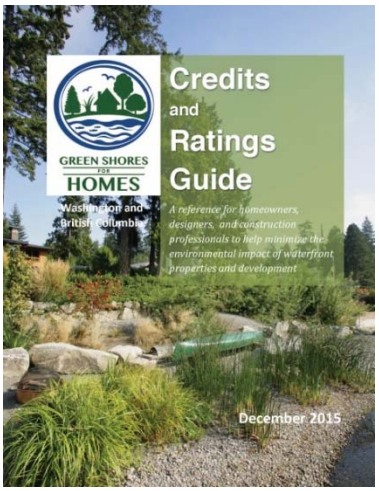
Green Shores was initiated in 2005 by SCBC, with support from multiple funding partners, to address coastal shore stewardship. The Green Shores for Coastal Development Credits and Ratings guide was published in 2010 and the Green Shores for Homes guide in 2015. Green Shores for Coastal Development has since expanded to include both marine and lake shoreline environments (similar to Green Shores for Homes), hence the name change from Green Shores for *Coastal* Development to Green Shores for *Shoreline* Development. The guide has also been expanded to apply to Atlantic Canada shorelines.

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

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

INTRODUCTION

Green Shores provides science-based tools and best practices guidelines for industry professionals in the planning, engineering, landscape architecture, ecological restoration and construction fields; for conservation organizations and local governments; and shoreline property owners interested in minimizing the environmental impacts of their projects in a cost-effective manner.



The Green Shores program recognizes that single residential waterfront lots account for the majority of shore developments. These properties present specific challenges for a rating system, particularly with respect to the degree of effort and cost required to address the rating credits through a rating process. Green Shores™ for Homes (2015, left image) has been developed for this purpose. More information on Green Shores for Homes is available online at **www.stewardshipcentrebc.ca/Green_shores**.

To fulfill its vision, the Green Shores program offers education and training (including a registry for Green Shores trained 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.

Overview of Green Shores for Shoreline Development

Green Shores for Shoreline Development (GSSD) provides a credit and rating tool for marine and freshwater lake shores that was developed following a review of existing Green Building rating and certification tools[2]. This review provided a summary of the fundamental characteristics of rating tools and allowed recommendations for the preferred approach for developing a Green Shores rating and assessment tool. In general, this approach follows that taken by the LEED™ Green Building rating system. Some Green Shores for Shoreline Development credits are adapted from LEED™ Canada and the US Green Building Council (LEED™ for Neighbourhoods or LEED™ ND) and others have been developed specifically to meet Green Shores principles.

Application of Green Shores

This guide applies to marine and lake shore environments from rocky to sand and gravel shores, estuaries to mud flats, and rock cliffs to coastal bluffs. Due to the different nature of rivers and streams, the current Green Shores guides do not apply to these systems. It is a goal to have a Green Shores credits and ratings system for rivers and streams in the future.

[2] Martine Desbois and Associates, 2006. A Review of Existing Assessment and Rating Tools and their Applicability to the *Green Shores* Project. Available from SCBC.

INTRODUCTION

Projects Addressed by Green Shores for Shoreline Development
Green Shores for Shoreline Development applies to 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). Marshland and tidal wetland restoration associated with the realignment of dykes, common in the Bay of Fundy, may be considered under this program on a case-by-case basis. Green Shores for Shoreline Development is not intended to be applied to major industrial developments that require a high degree of shore infrastructure (port facilities, industrial plants) or developments such as marinas with a large requirement for 'in water' activities such as dredging.

The Green Shores for Shoreline Development credits and ratings system now addresses park projects separately from other developments. A park is defined as any piece of land set aside as open space for the purposes of recreation or preservation of natural space, sometimes referred to as a greenfield. Parks can be publicly or privately owned. Due to the nature of the Green Shores approach, which awards projects for keeping shoreline systems intact, parks which may already meet all requirements would coincidentally see a more streamlined certification process. To ensure that both heavily altered sites and relatively intact sites can have an equal opportunity to a fair certification process, this credit and rating system requires that parks meet all prerequisites and have a higher total number of points to get a Bronze, Silver, or Gold Green Shores rating. A summary of prerequisites, credits, and rating levels can be found on page 8.

Green Shores for Shoreline Development encourages adoption of sustainability principles in the design process. Sustainable design requires:

- A strong vision and commitment on the part of the client and the project team from the start of the project;
- The use of lifecycle thinking which requires the team to consider the impacts of the project over its entire lifecycle. This goes beyond initial cost consideration and provides clarity on the actual long-term cost of a project;
- The use of whole system thinking which recognizes the interactions and relationships between different components and systems within a project and ensures that they work together;
- An in-depth understanding of the ecology, geomorphology, coastal or lake processes of the site in order to take advantage of landscape features during early project planning. Taking advantage of the site's natural features not only reduces local impact but can also avoid costs of development and infrastructure otherwise needed to overcome environmental challenges.

A Voluntary Program
Like most other environmental ratings/certification programs (certified wood, certified seafood, Green Buildings), Green Shores for Shoreline Development is voluntary and relies on support from industry, government, non-government organizations, building owners and the building sector for its adoption. By being voluntary, the system is able to incorporate leadership and

innovation into its framework, allowing development professionals concerned with environmental issues to differentiate themselves in the marketplace.

These volunteer programs can become mandatory when their application is required by a particular jurisdiction, generally local (municipal or regional) governments. Often a mandatory requirement relates to new buildings and developments tied to land purchase or lease, or a condition of rezoning or a master development agreement. On a broader scale, requirements within these voluntary programs may be incorporated into a Development Permit Area or local zoning regulations.

Using Green Shores for Shoreline Development

The Green Shores for Shoreline Development Guide will be useful to guide project proponents seeking Green Shores rating for their shoreline project, including:

- *Property owners, developers, real estate industry* – Organizations with a vested financial interest in shore property, associated buildings and their operation.
- *Professionals and professional associations* – Professionals and firms offering services such as building and landscape architecture, coastal, shoreline, water resources and geotechnical engineering, surveying, and biological assessment.
- *Construction contractors* – Firms and industry associations involved in construction of shore structures such as docks and piers, shore protection, and dredging.
- *Non-profit organizations* – Organizations with a special interest in shoreline environments and management issues.
- *Planners, regulators and elected officials* – Federal, provincial and local governments involved in planning, policy, and management of marine coastal and lakeshore areas.

Geographic Scope

Green Shores for Shoreline Development was originally developed and piloted in British Columbia on the west coast of North America. The program and rating system have since been expanded to the Atlantic coast of Canada and Canadian lake shores. This program does not address Arctic Canada or Alaska coasts.

Understanding Shore Zone Jurisdiction

Different areas of the shore zone may fall under different levels of government or First Nations jurisdiction. When designing a project, the development property must be considered in the context of a shore system, paying special attention to upland conditions and adjacent and down-drift areas on the shoreline. Work in these areas often requires consultation and approval from various government bodies. Where multiple agencies overlap, submit all required materials to those agencies and adhere to the most stringent standards for Green Shores rating. Note that these regulations may differ based on your region. See the Glossary for an example of shoreline jurisdiction in British Columbia (may be different in your area – check with your local planning office).

INTRODUCTION

The Green Shores for Shoreline Development Rating System

The Green Shores for Shoreline Development rating system has been developed as a tool for waterfront property owners and managers to develop their properties in a shore-friendly way that meets the Green Shores guiding principles. After meeting the five **prerequisites**, a shoreline project can be assessed using a series of **credits** for which a project can achieve **points**. All prerequisites, credits and maximum points available are provided in this guidance document.

Prerequisites, Credits and Points

The Green Shores for Shoreline Development rating system is built on a similar format to the LEED™ rating system, in that a rating is obtained by meeting all prerequisite criteria as well as a specific number of optional credits.

Prerequisites are required criteria for achieving a Green Shores for Shoreline Development rating. The prerequisites reflect current regulations in most Provinces and generally accepted environmental best management practices (BMPs)[3].

Credits are also required for a Green Shores rating. Documented achievement of the requirements outlined for each credit is rewarded by points that contribute to the overall rating for the project. Application for any specific credit is at the discretion of the project's design and construction team.

A Green Shores for Shoreline Development rating is achieved by meeting all prerequisites and an additional number of credits. A shoreline project may achieve one of three rating levels: Bronze, Silver, or Gold. The rating levels are set as a total of all applicable points.

Credit Format

Each credit is presented according to the following format:

- Intent – Defines the objective or intent of the credit from a Green Shores perspective.
- Context – The environmental or social context for the credit.
- Applies to – Describes the specific aspect of the design that is being evaluated for compliance in each prerequisite or credit (e.g., the shore zone or any buildings on the lot).
- Requirements – The measure(s) that must be achieved to meet the objective of the credit. If a particular standard applies, it is specified in this section.
- Submittal – The information required for submission by the applicant in order to assess whether the objective of the credit has been met.

[3] Best Management Practices are, by their nature, continuously advancing as more knowledge becomes available. A good list of technical references for shoreline BMPs can be found at the SAGE Coast website: http://www.sagecoast.org/info/sci-eng.html

- Strategies and Technologies – Provides general ideas and suggestions for project design and specifications.
- Resources – Key websites and documents, both general and regional, that can assist the design team in meeting the credit requirements.

Using the Rating Process

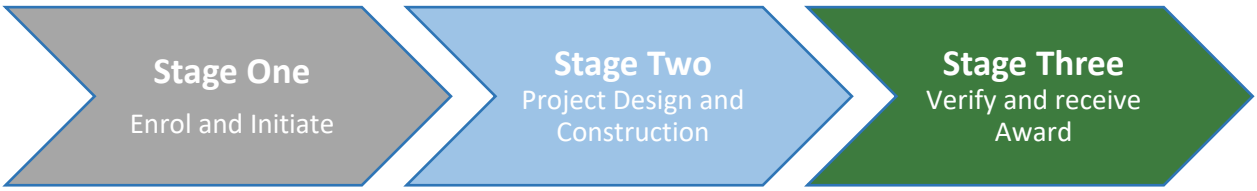


Figure 1. Steps in the GSSD rating process (Stewardship Centre for BC).

Stage One: Enrolment
Applicants can enrol on-line at **https://stewardshipcentrebc.ca/Green_shores/** or by contacting SCBC. It is recommended to enrol early in the project design and development process (pre-construction) to maximize the benefits of using the Credits and Ratings Guide. Early enrolment of a project provides access to essential information and tools such as the GSSD Submittal Template that outlines the requirements for submittals for the finalized project. Enrolment will also provide access to technical assistance in the interpretation of the credits. Owners of completed projects that wish to participate post-construction are also welcomed to enrol, however potential difficulties with this approach are noted below.

Stage Two: Project Design and Construction
Once the project is enrolled, the project team will typically proceed with the design and construction of the project. The team should become familiar early on with the requirements of each prerequisite and credit and ensure that, as the project progresses, all the documentation required for submittal (using the GSSD 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.

The GSSD Submittal Template (prepared in spreadsheet format), which is received as part of the enrolment package, guides the team in the compilation of the appropriate documentation for each prerequisite and applicable credits. However, the project team should use this Guide to provide the most accurate information on the submittal requirements. If there is a conflict between the Guide and the GSSD Submittal Template, the Guide prevails. The Submittal Template contains a complete list of required documentation, including an overall project narrative.

INTRODUCTION

Stage Three: Verify and Receive Award

Once all the documentation has been compiled, the applicant can submit their completed GSSD Submittal Template to the SCBC. The Stewardship Centre will then assign a GSSD verifier team to review the GSSD 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.

Prerequisites, Credits and Ratings Overview

The five GSSD prerequisites, ten optional credits, and three ratings levels are summarized below. Green Shores for Shoreline Development Guidelines requires parks (defined on page 2) to meet a higher credit standard for achieving the different rating levels. This is due to fewer constraints at parks, which typically do not have major buildings on small parcels.

Prerequisites	
Prerequisite 1	Siting of Permanent Structures
Prerequisite 2	Conservation of Shoreline Sediment Processes
Prerequisite 3	Conservation of Critical or Sensitive Habitats
Prerequisite 4	Riparian Zone Protection
Prerequisite 5	Construction Environmental Management Plan

Credits		
Credit 1	Site Design with Conservation of Shore Zone	1 to 3 points
Credit 2	Shore-Friendly Access	1 to 3 points
Credit 3	Re-Development of Contaminated Sites	2 points
Credit 4	Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes	2 to 9 points
Credit 5	Restoration/Enhancement of Aquatic Habitats	1 to 8 points
Credit 6	Enhanced Riparian Zone Protection	1 to 9 points
Credit 7	Integrated Stormwater Planning and Design	2 to 5 points
Credit 8	Climate Change Adaptation Plan	2 to 5 points
Credit 9	Exceptional Performance and Innovation	1 to 2 points
Credit 10	Outreach and Public Education	3 to 5 points

Ratings Levels	For All Sites
GSSD Bronze	All Prerequisites plus 10 points
GSSD Silver	All Prerequisites plus 16 points
GSSD Gold	All Prerequisites plus 22 points

Prerequisites

Prerequisite 1: Siting of Permanent Structures

Intent

A) To reduce the immediate and future need for shore protection and reduce the risk of property damage by locating permanent structures upland of areas subject to erosion and flooding, (B) to anticipate impacts due to sea level rise and climate change, and (C) to minimize impacts to fish and wildlife from overwater structures and excessive outdoor lighting.

Context

Poorly sited buildings and structures are at highest risk from episodic events such as flooding from storm surges, severe wave damage, extreme rainfall and related shoreline impacts such as erosion, particularly bluff erosion. Keeping permanent structures out of high-risk areas is the most practical and cost-effective way of reducing the threat to lives and property from floods and erosion.

A *permanent structure* is defined as any building or structure lawfully constructed, placed or erected upon a secure and long-lasting foundation (or piling) on land or over water which adheres to local government bylaws or approval conditions in effect at the time of construction or placement. This includes paved rights-of-way on land and docks and "overwater walkways." Buildings or other structures which are designed to be relocated (to accommodate sea level rise) are not considered permanent structures. Projects which include buildings or other structures on a foundation which will not meet the setback requirement will need to develop a realistic relocation strategy into the overall project. Gravel walkways are not considered permanent structures for the purposes of this document, but they and other walkways/trails may affect runoff and thus need to be addressed in Credit 7.

Appropriate siting of buildings and other permanent structures requires an understanding of the physical processes at the development site (explained in the next prerequisite) and reduces present and future costly requirements for habitat compensation and shore protection works. A comprehensive understanding of the physical processes affecting a site also encourages modern innovation in design, which can prevent both unnecessary structures (such as hardening of the shoreline) and unnecessary costs.

Non-Conforming Structures

This prerequisite applies to the siting of new permanent structures on the development site. Pre-existing structures that do not meet this requirement are considered non-conforming. However, a non-conforming site will still have to meet the requirements of other prerequisites. For example, Prerequisite 2 provides for compensatory measures if an adequate setback cannot be achieved due to existing site conditions.

Prerequisite 1: Siting of Permanent Structures REQUIRED

It is also important to carefully site permanent structures to protect them and the shore environment from the effects of climate change. Climate change impacts including sea level rise (SLR) and erosion are projected to increase in the coming decades in most regions. Sea level rise will affect all marine shores to varying degrees based on the variables discussed further below. Other implications of climate change are associated with altered climate patterns, including changes in precipitation, storm intensity, snow melt, and loss of ice cover and biota, and will have similar impacts on both marine and lake shores; these should be addressed in all project planning and design elements. Sea level rise is projected to be greater in Atlantic regions than for the Pacific coast[4]. Projections differ depending on location relative to cryospheric inputs, ocean currents, and local vertical land movement (VLM), such as subsidence or isostatic uplift. VLM can vary considerably across relatively short distances and should be addressed with local data to develop a relative sea level rise projection for the subject site[5]. High resolution topography (e.g. digital elevation models using technology such as LIDAR), underlying geology, and shoreline landform type (shore type) are also relevant to understanding how marine shorelines will respond to sea level rise. Along many shorelines, shoreline recession and erosion are likely to occur at accelerated rates. It is important to reference the best available science[6] when siting structures to accommodate for these anticipated changes.

Climate change is also expected to impact lakes and reservoirs. Many lakes are reservoirs whose water levels are controlled by weirs and dams. Hotter, drier summers may necessitate the capture and retention of greater volumes of water in these reservoirs in order to sustain downstream flows in summer. In some areas, when combined with more intense rainfall or rapid snowmelt, this may lead to increased flooding and erosion along reservoir shorelines due to extreme water level variation between winter and summer.

One example of a permanent structure that applies in this credit is an overwater structure. Overwater structures such as docks, walkways, boathouses and marinas offer access to the water, but can often have negative impacts to the shore environment. These impacts may come from the structure itself and/or from any associated lighting on or near the structure. The processes of natural light transmission, water flow and

Public Bike Trails and Walkways

As public bike trails and walkways are highly desirable elements of waterfront development, these structures are not generally considered permanent structures (see Glossary for definition) and do not have to meet the setback condition outlined above. Public walkways and bikeways that have an engineered concrete or other foundation that cannot practically be elevated or moved will be considered a permanent structure and shall meet the vertical elevation standard stipulated below and the requirements of other prerequisites (including the riparian and shoreline sediment process prerequisites).

[4] Han et al. 2016; James et al. 2014
[5] James et al, 2014
[6] Best available science (BAS) generally refers to the collection of publicly available peer-reviewed literature conducted by trained experts that reflects the current scientific understanding of an issue in an objective and politically neutral manner. BAS often refers to the most recent publications, but this is not always the case.

Prerequisite 1: Siting of Permanent Structures REQUIRED

nearshore connectivity can be altered or halted, often negatively affecting submerged aquatic vegetation, sediment transport, fish passage migration corridors, and other parameters[7]. For example, uncontrolled lighting can negatively impact fish and wildlife by making it more difficult for organisms to hide, orient themselves, or forage[8]. Overwater structures can be designed to reduce these and other impacts through the use of light-permeable deck design, reduced length and width over the water, minimal across shore fill material, proper orientation, and minimal associated lighting.

Applies to

Any *new* permanent structure that has its foundation situated within the development property, although effects on shoreline processes beyond the property boundaries (both in the foreshore and along adjacent properties) must be considered when addressing requirements and submittals. If the permanent structure includes an overwater structure such as a dock, walkway, boathouse, or marina, additional submittal materials are required under both Options A and B (detailed below).

Two options are available for project applicants to choose from in order to meet the horizontal setback aspect portion of Prerequisite 1:

Option A is expected to cover most projects. Option A uses a set of standard minimum setback distances based on shore types and bank height (see table on the following page). Note that hazards associated with erosion and flooding differ; horizontal setback distances address erosion issues, while vertical setback distances address storm surges and sea level rise.

Figure 2. Examples of shore under Option A requirements (more easily eroded shores, left; Point Gray, Vancouver) or Option B requirements (non-eroding shores, right, Gulf Islands) (Coastal Geologic Services Inc.).

[7] The Fisheries Act, Habitat Protection Provisions, Fisheries and Oceans Canada
[8] LEED v.4 Light Pollution Reduction, Canada Green Building Council (2018)

Prerequisite 1: Siting of Permanent Structures REQUIRED

Option B is available for project sites that do not use the standard minimum setback under Option A or where more detailed analysis of a site demonstrates that the permanent structures will not be threatened by erosion or inundation within the lifetime of the structure.

Horizontal Setback Requirements for Option A

Option A uses a minimum structure setback distance based on different shore types and elevations and their varying vulnerability to erosion, bank recession and inundation. The geology of the shore type is relevant to whether the shore is actively receding. Sites without any type of bank, such as barrier beach sites, will have setbacks from the 1 in 100-year water level plus sea level rise projected over the lifetime of the structure. Other sites have setback distances measured from the bluff or bank crest (see Table 1).

Table 1. Minimum setback distances for Option A.

Shore Type	Geology	Minimum Horizontal Setback Distance Use the maximum of the following measurements:
Low elevation shore	Beach deposits; gravel and sand	Extreme WL limit 25m from NB/OHWM Annual erosion rate multiplied by lifetime of structure
Low bank (less than 5m in height)	Glacial/unconsolidated	30m from crest Extreme WL limit Annual erosion rate multiplied by lifetime of structure
High bluff (5-60m)	Glacial/unconsolidated	35m from crest Extreme WL limit Annual erosion rate multiplied by lifetime of structure
Very High bluff height (60+ m)	Glacial/unconsolidated	40m from crest Extreme WL limit Annual erosion rate multiplied by lifetime of structure
Low cliff height (less than 5m)	Non erodible Bedrock	20m from crest Extreme WL limit
High cliff height (5-60m)	Non erodible Bedrock	20m from crest Extreme WL limit
Very high cliff height (60+ m)	Non erodible Bedrock	25m from crest Extreme WL limit
Dike or other shore flood protection measure	Variable or Artificial materials	7.5m from landward edge Check local regulations for areas outside of BC

Table 1 Notes:

- Extreme WL = 1 in 100-year storm surge water elevation + projected sea level rise over the lifetime of the structure in its proposed initial location or its potential future location.
- Setback to be equal to or greater than required by local regulations.
- NB/OHWM = Natural Boundary/Ordinary High Water Mark, whichever is the most common term for your area.

Prerequisite 1: Siting of Permanent Structures REQUIRED

Proposed permanent structures setbacks are intended to allow for safe development of sites and reduce the risks of erosion/recession of the shore or inundation within the lifetime of the structure or development. A second goal is to locate all permanent structures in a manner that reduces the need for future protective works and reduces or avoids negative impacts of overwater structures and lighting. All proposed setback distance requirements should be equal to or greater than what is required by local or provincial government or as established through regional environmental protection, hazard prevention or other reasons if these levels are more stringent than stipulated above. Applicants are required to submit proof that they meet local setback requirements.

Infilling to Meet Vertical Requirements

On green field sites or previously developed sites without infill, infilling of low-lying areas is not an acceptable approach to meet the vertical elevation prerequisite.

On previously developed sites with existing infill additional fill can be added to the building site to meet the vertical elevation requirement if it is combined with a restoration effort in upland areas of the site.

Horizontal Setback Requirements for Option B

Under Option B, the siting of any permanent structure must allow for natural erosion and sea level rise to take its course over the lifetime of the structure, without the need for future shore protection to protect permanent structures. Projects must meet or exceed any local requirements.

Additional Requirements for both Options A and B

Vertical Elevation

1. Building or permanent structures shall also meet or exceed flood construction levels established locally, regionally or provincially if these levels are more stringent than stipulated above.
2. The occupied portions of a building or permanent structure shall be at least 1.5m above the highest elevation among the NB/OHWM, the HHWLT (or the line from where the setback indicated above is measured plus the projected sea level rise over the lifetime of the structure using current best available science).

Overwater Structures – Marine and Freshwater

In order to meet this prerequisite, new overwater structures must meet the following criteria:

1. Local regulations allow the construction of overwater structures at the site;
2. Appropriate regulatory approvals have been obtained, including demonstration that the dock design and construction does not impact sensitive or critical habitats; and
3. The shoreline conditions make the construction and operation of an overwater structure feasible – i.e., the

Adaptable Design of Overwater Structures

Where the opportunity exists, overwater structures may incorporate adaptable designs to allow for upward movement of the structure as sea levels rises.

Prerequisite 1: Siting of Permanent Structures REQUIRED

site is not subject to excessive wave exposure, strong currents, breaking waves or swell. This is subject to evaluation by a Qualified Coastal Professional (see Glossary). These conditions are less common in lakes.

Overwater Structures – Marine[9,10]

1. Docks must not extend more than 60m from the present NB/OHWM
2. Moorage platforms and floats must not exceed 14m in length or 3.7m in width
3. If present, walkways must not exceed 1.8m in width
4. No creosote treated materials should be used
5. Spacing of piles is wide enough such that longshore drift is not impeded (see Prerequisite 2)

Overwater Structures – Freshwater

1. Docks must not extend more than 42m from the point where the walkway begins, measured perpendicular from the general trend of the shoreline surrounding the dock
2. Moorage platforms or floats must not exceed 3m in width
3. Walkways or ramps must not exceed 1.5 min width

Outdoor Lighting

1. Within the shore zone above the NB/OHWM:
   - Only light external areas of the site as required for safety and comfort
   - Install automatic controls to turn off exterior lighting when sufficient daylight is available and during nighttime hours when lighting is not required
   - Use motion detectors to reduce exterior lighting levels within the shore zone by at least 50% when no activity has been detected for 15 minutes
2. Within the shore zone below the NB/OHWM:
   - Meet the requirements specified for the shore zone above the NB/OHWM, and demonstrate lighting design that minimizes overwater and foreshore lighting to the greatest extent practical, with emphasis on reducing lighting directed into the water so as not to attract or disturb fish.

Submittals – Vertical Elevation and Horizontal Setbacks Option A

1. The Letter Template signed by a Qualified Coastal Professional (see Glossary for definition).
2. A scaled annotated site plan indicating the following:
   a. NB/OHWM (or HHWLT for large Atlantic coast sites)
   b. 1 in 100-year flood elevation for low bank and low elevation shores
   c. Local erosion rate
   d. Sea level rise projections for the following 50 years
   e. Local flood elevation requirements
   f. Local setback requirements

[9] Please note that local zoning or regulations apply if they are more stringent than specified in this Guide.
[10] Crown Land and Land Act regulations, Fisheries and Navigable Waters Acts, Department of Fisheries and Oceans Canada.

Prerequisite 1: Siting of Permanent Structures REQUIRED

Plan should also include:

- Site elevations and contours relative to a defined vertical datum (geodetic CGVD2013 or chart datum), at a minimum 1m contour interval.
- The surveyed NB/OHWM and its elevations, relative to a defined vertical datum (geodetic CGVD2013 or chart datum). The location and elevations of all occupied portions of permanent structures relative to the vertical datum of the site plan.
- Shoreline geology or character and, where appropriate, depth to bedrock or firm strata and size distribution of surface sediments.
- The location and elevation of bank or bluff crest, relative to the vertical datum of the site plan.

Submittals – Vertical Elevation and Horizontal Setbacks Option B

1. The Letter Template signed by a Qualified Coastal Professional.
2. A scaled annotated site plan showing all the information required under the Option A submittal above, and a topographic survey of the uplands and intertidal portion of the development property shore, and, if appropriate, hydrographic survey or largest available scale hydrographic chart offshore of the project site.
3. Design basis report stating the proposed setback and justification on why it differs from the Option A requirements. This report should address the following:
    - Project or service life of the development
    - Shoreline geology or character and, where appropriate, depth to bedrock or firm strata and size distribution of surface sediments
    - Description of the coastal processes on and adjacent to the project property within the limits of the affected coastal reach
    - Tidal range and expected 1 in 20-year storm surge at site (marine shores only)
    - A description of the following
        1. HHWLT or NB/OHWM
        2. 1 in 20-year flood elevation for low bank and low elevation shores
        3. Sea level rise projections for the following 50 years
        4. Local erosion rate
        5. Local flood elevation requirements
        6. Local setback requirements
    - BAS (Best Available Science) projection and source(s) used for long-term sea level rise and impacts of climate change for the project area[11]
    - Exposure of site to winds and waves (fetch distance)
    - Exposure of site to tidal or wave driven currents
    - Estimated long-term, mean rate of erosion or accretion for the site shore

[11] Effects of climate change, like flooding and increased intensity of storms, may also impact lake shores. Cite the BAS for these impacts if the project site is on a lake shore. If there is no BAS documentation on the specific project area, applicants may also refer to shores with similar characteristics in a similar location and provide additional justification.

Prerequisite 1: Siting of Permanent Structures REQUIRED

- Any other appropriate documentation supporting the proposed setback
- Sources for listed information

Submittals - Overwater Structures and Outdoor Lighting for Options A and B

1. The Letter Template stating that all exterior lights have been designed in accordance with the requirements of this credit and signed by the proponent's responsible party.
2. Exterior and overwater lighting site plan, demonstrating design used to minimize overwater lighting if applicable.
3. A dock design drawing if applicable.

Strategies and Technologies

The following considerations and planning activities will help address the credit requirement:

- Topographic and hydrographic survey data are key to addressing the submittal requirements. Use the relevant portion of the largest available scale hydrographic chart offshore of the project site. In most cases it will be necessary to conduct a site survey to determine site elevations throughout the foreshore frontage and over the site to define the elevation of significant features and the NB/OHWM relative to an accepted reference datum such as hydrographic chart datum or geodetic datum.
- Verify existing legal boundaries and determine if erosion or accretion has occurred since the original or pre-existing legal survey.
- Consider establishing restrictive covenants on lands near erodible shores or steep bluffs to prevent irresponsible building into the future, beyond the life of the project.
- Consider seasonal and annual changes to shore features within the shore section in which the development property is located. A beach shore can change considerably during the winter storm season. Site building structures to account for these changes. Consult air photos of the site taken at different times throughout the year and over longer intervals that span decadal-scale cycles of episodic natural phenomena.

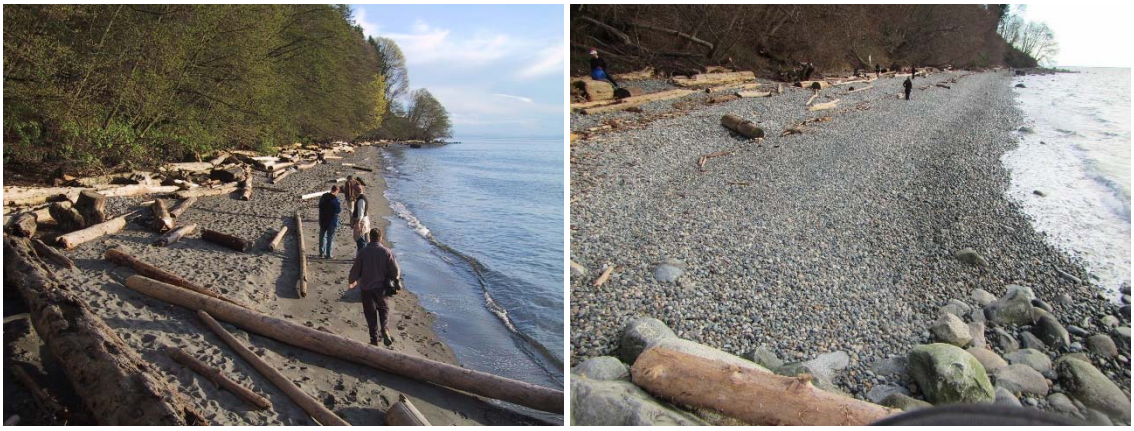


Figure 3. Examples of ground photos over time showing changes in beach sediment, backshore, and drift logs. Pacific Spirit Regional Park beach nourishment project in Trail 4 area, 2003 (left) and 2019 (right), Vancouver, BC (Coastal Geologic Services, Inc.).

Prerequisite 1: Siting of Permanent Structures REQUIRED

- Assess shoreline features and processes and identify potentially sensitive sites such as bluffs, beaches and spits and assess pre-development and current shoreline processes.
- Look for pre-existing features such as culverts, creeks, landslide deposits or other hazards that could potentially affect building siting.
- Incorporate site features into building siting, for example locating a permanent structure on a section of bedrock shore will reduce the need for costly shore protection and may allow the building to be located closer to the water.
- Use existing regional models to account for sea level rise and other climate change effects to 2100 or over the life of the project.
- Reference current or best available Flood Construction Levels (FCLs) when siting structures in flood hazard areas. The Flood Hazard Area Land Use Management Guidelines for British Columbia[12] require that the minimum FCL for 2100 for the underside of a wooden floor system or top of concrete slab for permanent structures should be the sum of:
  - The 1:200 or 1:500 flood
  - Annual Exceedance Probability (AEP) of total water level as determined by probabilistic analysis of tides and storm surge (where applicable)
  - Allowance for future SLR to the year 2100
  - Allowance for regional uplift or subsidence to the year 2100
  - Estimated wave effects associated with a storm with an AEP of 1:200 or 1:500
  - A minimum freeboard of 0.6m.

Measuring the Natural Boundary/Ordinary High Water Mark (NB/OHWM)

- The natural boundary is best determined by surveying to a known vertical datum the elevation of the lower limit of *terrestrial* vegetation (see Glossary for definition). This elevation may vary over the site depending on the degree and aspect of wave exposure, geomorphology and site geology. The upper limit of *aquatic* vegetation should not be used to determine the natural boundary as storm surge or wave run-up often extends beyond the limit of aquatic vegetation except in sheltered areas.
- For large sites in Atlantic Canada (with shore exceeding 500m) it is acceptable to use the higher high water large tide (HHWLT) line if OHWM is not available.
- Where wetlands and/or salt marshes are present, a wetland delineation should be undertaken to identify the natural boundary. Contact your provincial environment department to find out if this process is used in your region.
- On altered shores (seawalls and riprap) there is often no terrestrial vegetation seaward of the crest of the altered shoreline and it is difficult to determine the elevation of the natural boundary. In this case it may be necessary to extrapolate the elevation of the

[12] Amendment Sections 3.5 and 3.6, "Flood Hazard Area Land Use Management Guidelines", British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (January 2018).

Prerequisite 1: Siting of Permanent Structures REQUIRED

natural boundary from an adjacent site, or use a physical indication such as higher high water large tide (HHWLT) plus an allowance for storm surge.

- For reservoirs, the natural boundary may be referred to as "full pool," which is generally the high water mark. In large reservoirs, the issue of longer fetch and seiches (standing waves) may complicate the identification of the high water mark. It is recommended to have a professional review of reservoir water levels to determine the appropriate natural boundary.
- Whichever method is used to delineate the natural boundary at the site, submittals must include documentation of the methods and the mark must be labeled on all maps or site plans. Have this work performed or verified by a Qualified Coastal Professional.

Prerequisite 1: Siting of Permanent Structures REQUIRED

Resources

General

Canada's Marine Coasts in a Changing Climate
https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/files/pdf/NRCAN_fullBook%20%20accessible.pdf
Ocean, Coastal and River Engineering Research Centre
https://nrc.canada.ca/en/research-development/research-collaboration/research-centres/ocean-coastal-river-engineering-research-centre
Your Marine Waterfront
https://www.stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/YourMarineWaterfront_CanadianEdition.pdf
Marine Shoreline Design Guidelines
https://wdfw.wa.gov/publications/01583/
Navigable Waters Protection Act, Department of Transport Canada
https://www.tc.gc.ca/eng/programs-675.html
The New England Light Pollution Advisory Group (General information on outdoor lighting issues)
http://www.icq.eps.harvard.edu/nelpag/nelpag.html
Sensible Shoreland Lighting (Wisconsin DNR)
https://dnr.wi.gov/topic/ShorelandZoning/documents/shorelandlighting.pdf
Sea Level Rise Considerations for nearshore restoration projects in Puget Sound
http://www.wacoastalnetwork.com/files/theme/wcrp/considerations/Restoration-Raymondetal.2018-compressed.pdf

British Columbia

Natural Resource Stewardship
https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship
Coastal Stewardship Guide for Planners, Builders and Developers
http://stewardshipcentrebc.ca/portfolio/coastal-shore-stewardship/
Sustainable Urban Landscapes – Site Design Manual
https://www.toolkit.bc.ca/resource/urban-landscapes
Flood Hazard Area Land Use Management Guidelines (2018 amendment)
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/final_amendment_to_s_35_and_36_fhalumg_17-10-01.pdf

Atlantic Canada

A Guide to Land Use Planning in Coastal Areas of the Maritime Provinces
http://www.dfo-mpo.gc.ca/Library/316491.pdf
Coastal and Ocean Information Network Atlantic (COINAtlantic) Land Use Planning Topics
https://coinatlantic.ca/index.php/themes/coastal-industrial-development/land-use-planning
Provincial Flood Risk Reduction Strategy (New Brunswick)
http://leg-horizon.gnb.ca/e-repository/monographs/31000000049274/31000000049274.pdf
Prince Edward Island Coastal Property Guide
https://www.princeedwardisland.ca/sites/default/files/publications/prince_edward_island_coastal_property_guide.pdf
Environmental Guidelines for Construction and Maintenance of Wharves, Breakwaters, Slipways, and Boathouses (Newfoundland and Labrador)
https://www.mae.gov.nl.ca/waterres/regulations/appforms/Guidelines_for_Wharves.pdf

Prerequisite 2: Conservation of Shoreline Sediment Processes

Intent

To ensure that shore development does not significantly reduce sediment supply or sediment transport within the coastal or lakeshore environment.

Context

Sediment supply to the shore is from bank erosion, re-working of nearshore sediments and river and stream input. Erosion at shoreline banks or bluffs (feeder bluffs) is an important element of the shore sediment system because the eroded material nourishes the foreshore as well as other nearshore features in the region. Developments on the upland or foreshore may affect the natural supply of sediment to and along the shore. Most commonly, hardening of shores through seawall and riprap structures reduces the sediment supply to the shore zone, unless the shore is in a natural depositional zone (i.e., slow or still currents allow sediment to deposit).

Natural processes often lead to some amount of sediment loss from the foreshore, such that continued inputs are needed to maintain the foreshore. Channelization of stream mouths can also lead to the loss of sediment from the foreshore through transport of stream sediment directly to deep water.

Properties are often 'connected' by longshore sediment transport (also called littoral transport or net shore-drift) and alteration of sediment supply or blockage of sediment movement at the development property can cause erosion at nearby, 'down-drift' properties. Impacts to longshore sediment transport are usually caused by placement of structures (groynes, breakwaters) across the foreshore such that longshore sediment transport is disrupted.

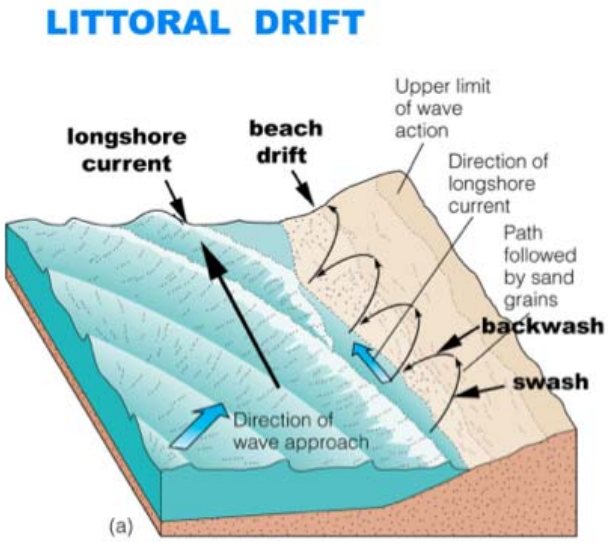


Figure 3. Littoral drift (Brooks/Cole Thomson, 2006).

Lake & Reservoir Shores
Lakes fed by rivers and streams, as well as larger wind-exposed lakes, can exhibit longshore (littoral) transport patterns similar to marine coasts.

Prerequisite 2: Conservation of Shoreline Sediment Processes

REQUIRED

Pocket beaches are not in a longshore sediment transport system, and input from banks or streams within the pocket beach are the only source of sediment input. A pocket beach is a crescent-shaped beach situated between two rocky headlands that exhibits cross-shore rather than longshore sediment transport. These areas are often favoured environments for migrating salmon in the marine environment and are a priority shore type for restoration or protection.

Applies to

The development property (both upland and foreshore), although consideration of shoreline processes beyond the property boundaries is required.

Requirements

1. Shore Sediment Supply
   (a) Site development must be designed such that the need for shore protection works is not required over the greater of the life of the project or a 50-year cycle of natural erosion including allowance for rising water levels due to SLR.

   OR

   (b) If site features or pre-existing developments do not allow (a) to be met, and existing shore protection needs to be partially or wholly maintained, or new shore protection is required, then provide a design that will emulate natural sediment supply to the foreshore for a 50-year cycle of natural erosion or the life of the project (with allowance for SLR impacts), whichever is greater. The size and quality of the supplied sediment must be appropriate to the site (e.g., be similar in size and quality to that which would be generated by natural erosion, or slightly coarser if needed).

   (c) If sediment nourishment is required per the design in (b), provide a post-construction monitoring plan that outlines methods and time frame for tracking the success of nourishment (see details in *Submittals).*

2. Longshore Sediment Transport
   a) The proposed shore development must not alter longshore sediment transport to such an extent that the **risk of adverse impacts**, including erosion, to the development site and adjacent properties is increased.

Sediment Transport Assessment and Mapping

In many cases the sediment transport mapping should encompass a larger area than the project shoreline, as shoreline processes occur on a shore reach or drift cell scale. An advantage of this larger scale mapping is that such a report may be applicable to several properties within a shore reach or drift cell. Some protected sites may have insignificant shoreline sediment processes. In these cases, the sediment transport assessment should provide the rationale for concluding that sediment transport processes are not a significant consideration.

Risk of Adverse Impacts

This is defined as the high exposure to damages that require the installation of shore protection works for development property or adjacent properties.

Prerequisite 2: Conservation of Shoreline Sediment Processes — REQUIRED

b) If the site has pre-existing shore modifications including shore projection and fill, the proposed design must improve longshore sediment transport.

Submittals

For bedrock shores with no planned 'in water' structures:

1. The Letter Template signed by a Qualified Coastal Professional stating that the site is comprised of rocky shore and that no 'in water' structures are planned that could impede sediment transport along the shore.

For all other shore types (including lakes):

1. The Letter Template signed by a Qualified Coastal Professional stating that, over the design life of the project or 50 years, whichever is greater, the project has been designed such that the need to install shore protection works is very unlikely or, if shore protection is required, the project incorporates mitigation designs to compensate for any potential impacts to natural sediment supply.
2. Coastal/shoreline sediment transport assessment and mapping based on existing aerial photo interpretation, a site visit (low tide for marine shores) and supporting analysis showing:
    - Dominant and seasonal sediment transport pathways and direction on the project and adjacent properties
    - Sediment sources relevant to the project property
    - Sediment sinks or depositional areas that may be connected to the project property or affected by changes to the property shore
3. Supporting documentation including the following topics if relevant to the site:
    - Property geology, including grain size of surficial sediments
    - Pre-existing and existing stability (erosion/accretion rates) that establishes the most likely scenario for 50 years or the project life span

Bedrock Shores

Bedrock shores are defined as being more than 75% bedrock above the high tide level, or normal lake level. These shores are resistant to erosion and do not contribute sediment to the coastal system. However, sediment transport can occur along rocky shores as part of broader scale longshore sediment processes and could be impacted by hard structures (groynes, breakwaters) placed in the intertidal or subtidal zone. If no 'in water' structures are planned, and no impacts to coastal sediment transport are expected for rocky shores a sediment transport assessment is not required.

Permitting

Shore protection structures or beach nourishment must meet provincial design guidance and permitting requirements and not encroach beyond the existing NB/OHWM without provincial (use of Crown foreshore) and federal (Fisheries Act and Navigable Waters Act) authorization.

Prerequisite 2: Conservation of Shoreline Sediment Processes — REQUIRED

- Expected sediment supply and transport prior to and following completion of proposed works
- Proposed design and identification of mitigation strategies, including measures to restore any disruption to the foreshore to the pre-existing elevation if erosion at the toe of protective structures may lower the beach elevation. Plan view and cross section drawings need to be signed and stamped by a Qualified Coastal Professional.

4. A post-construction monitoring and sediment nourishment plan, if required. Where sacrificial materials are proposed (i.e., sediments that are designed to erode over time), the volume, texture and form must be justified in terms of existing geology and stability calculations. The monitoring plan must include methods and a timeline for documenting the success of beach nourishment, a time frame, and a financial commitment to complete the monitoring plan and implement maintenance or remedial measures if required. Typical plans span a minimum of three years; check with your local agencies to determine the required monitoring time frame.
5. Any required permits or authorizations from local, provincial or federal government agencies, and First Nations representatives.

Strategies and Technologies

Where erosion is of concern, consider beach berms or, if shore hardening is required, couple the protective structure with sacrificial (nourishment) sediment that is similar in composition to native sediment to emulate the natural erosion process. This may include one or a combination of the following measures with the engagement of a Qualified Coastal Professional throughout the entire design process:

- Use of a naturally sloped backshore and restored riparian vegetation
- Beach nourishment with appropriately designed beach slope and sand/gravel sediment to reduce wave run-up and protect upland property
- Beach berms and anchored logs to provide sufficient shore protection in less exposed areas
- Use of bioengineering techniques to stabilize and revegetate embankments
- Use of a buried hard structure in the adjacent uplands as a setback ‘sea defence’, coupled with beach nourishment or a beach berm
- Living shorelines coupled with sills or hybrid systems where agitation levels require additional reinforcement.

Shore protection structures that encroach beyond the existing NB/OHWM can also impact public access along the beach at high tide. In addition, erosion at the toe of seawalls and riprap structures can lower the beach elevation at the base of the shore protection structure, impacting public access at higher tides. To reduce impacts to public access along the shore locate any necessary hard protection structures (seawalls or revetments) so that the entire structure is landward of the existing NB/OHWM and restore any disruption to the foreshore to the pre-existing elevation or higher.

Prerequisite 2: Conservation of Shoreline Sediment Processes

REQUIRED

Resources

General

Review of Alternative Shore Stabilization Projects in Puget Sound
https://salishsearestoration.org/images/b/b2/Gerstel_%26_Brown_2006_alternative_shoreline_stabilization.pdf
Alternatives to Bulkheads
https://s3.wp.wsu.edu/uploads/sites/2064/2014/02/July-August-2016-Natural-Alternatives-to-Bulkheads.pdf
https://www.kitsapgov.com/dcd/FormsandBrochures/Bulkhead%20Alternatives.pdf
The Tide Doesn't Go Out Anymore
http://www.mobilebaynep.com/images/uploads/library/Effect_of_Bulkheads_on_Urban_Shorelines.pdf
Living Shorelines – NOAA
https://www.habitatblueprint.noaa.gov/living-shorelines/
Living Shorelines – Permit 54 US Corp. of Engineers
https://www.nao.usace.army.mil/Portals/31/docs/regulatory/nationwidepermits/Nationwide%20Permit%2054.pdf
Cold Regions Living Shorelines Community of Practice (CRLS CoP)
https://www.ccadaptation.ca/en/crlscop

British Columbia

Chapter Two - Coastal Shore Stewardship Guide
https://www.stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/Coastal.pdf

Atlantic Canada

Atlantic Climate Adaptation Solutions Association – Guidance for Coastal Flooding and Erosion Adaptation
https://atlanticadaptation.ca/en/ccat
Leys, V., Bryce, D. (2016). Adapting to Climate Change in Coastal Communities of the Atlantic Provinces, Canada: Land Use Planning and Engineering and Natural Approaches - Part 3: Engineering Tools Adaptation Options
Prince Edward Island climate change adaptation
https://www.princeedwardisland.ca/sites/default/files/publications/pe_climate_change_adaptation_recommendations_draft.pdf
Catto, N., 2011. Coastal Erosion in Newfoundland. Department of Geography, Memorial University
https://coinatlantic.ca/images/documents/Coastal-Erosion-in-Newfoundland-Report-2011.pdf
Adapting to Climate Change in Coastal Communities of the Atlantic Provinces, Canada: Land Use Planning and Engineering and Natural Approaches
https://atlanticadaptation.ca/en/islandora/object/acasa%3A786
Visualizing coastal erosion and sea level rise
https://climatechange.novascotia.ca/sites/default/files/uploads/2013-2014_EAC.pdf

Prerequisite 3: Conservation of Critical or Sensitive Habitats — REQUIRED

Prerequisite 3: Conservation of Critical or Sensitive Habitats

Intent
To conserve and minimize impacts to existing critical or sensitive natural features and functions of the shore zone and protect endangered and threatened species and their habitats. These may include eelgrass beds, fish spawning areas, shellfish beds, marshes, estuaries, beach backshore/ dunes for nesting habitat, and others on marine shores. Critical freshwater habitats include wetlands, reed beds, and those portions of lake shores adjacent to streams and river mouths, which provide important feeding, resting, spawning, nesting or rearing habitat for species designated at risk or protected under federal or provincial regulations.

Context
Sensitive and critical fish and wildlife habitats are generally protected by federal (e.g., Fisheries Act, Species at Risk Act), provincial and local government regulations. The objective of this prerequisite is to ensure that these regulatory conditions are met at the development site level.

Applies to
The development shore zone, especially the setback zone as defined in Prerequisite 1 including the riparian zone, foreshore and shallow subtidal zone if applicable. Including these areas on the site plan ensures mitigation efforts consider the site in the "big picture" context of a connected shore zone ecosystem.

Requirements
No net loss of critical or sensitive habitats located within the development shore zone. No net loss means any losses of existing critical or sensitive habitats must be offset with compensatory mitigation *within the site project*. Compensation options are limited to on-site areas as Green Shores principles require conservation of proper functioning conditions at the development site level as well as continuity of physical and biological processes and function within the reach of shore where the development is located. Off-site compensation for losses to existing critical or sensitive habitats cannot be used to meet this prerequisite.

A post-construction monitoring plan is required for all projects that use on-site compensation to achieve no net loss (details in *Submittals).*

Submittals
1. The applicable Submittal Template signed by a Qualified Environmental Professional.
2. A scaled map of the project shore zone (riparian, foreshore [intertidal and shallow subtidal zones] if 'in water' works are planned) showing the location and extent of all critical or sensitive habitats (including federally or provincially designated areas) in the shore zone in relation to the planned development works, including adjacent shores.

Prerequisite 3: Conservation of Critical or Sensitive Habitats — REQUIRED

3. A copy of the approvals or permits from the appropriate regulatory agency or agencies demonstrating that no critical or sensitive habitats will be impacted,
   OR
   A copy of the approved post-construction monitoring/on-site compensation plan demonstrating no net loss for any critical or sensitive habitats that will be impacted. The plan, if required, must include: an approved monitoring program to assess and confirm the functionality of any compensation measures; benchmarks for habitat functionality, including viability; time frame; and a financial commitment to complete the monitoring plan and implement maintenance or remedial measures if required.

Strategies and Technologies

- Select a Qualified Environmental Professional to identify and delineate areas with critical or sensitive habitats.
- Avoid fill or protective works in foreshore areas with critical or sensitive habitats; work with designs that use valued habitat features as part of the shore protection or landscape design.
- Site overwater structures (docks, walkways, piers), over areas with little or no vegetation and use grated surfaces on pile structures placed over vegetative features to allow light penetration.
- Avoid landscaping or siting structures and roads in or adjacent to marshes or wetlands.
- Minimize outdoor lighting.
- Restore areas impacted by the development/construction activities, or previously degraded areas (if needing to compensate for unavoidable habitat losses) to meet or exceed no net loss.
- Check whether your site falls within a designated environmentally sensitive or significant area. These areas often encompass a larger area within the region and come with their own regulatory requirements.

Prerequisite 3: Conservation of Critical or Sensitive Habitats — REQUIRED

Resources

General

Canadian Species at Risk Act (SARA) website
https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/about-species-at-risk-act.html
Fisheries and Oceans: Projects near water
http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html
RAMSAR International Wetlands https://www.ramsar.org/wetland/canada
Marine Protected Areas http://www.dfo-mpo.gc.ca/oceans/mpa-zpm/index-eng.html
Protected Areas (Canada) https://www.canada.ca/en/services/environment/conservation/protected-areas.html
Canadian Council of Ecological Areas (Conservation Areas Reporting and Tracking System)
https://ccea.org/carts/
Conservation and Protection of Canada's Forests (NRCAN)
https://www.nrcan.gc.ca/forests/canada/conservation-protection/17501

British Columbia

BC Conservation Data Centre
https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre
BC Sensitive Ecosystems Inventory
http://www.env.gov.bc.ca/sei/
Shoreline Structures Environmental Design: A Guide for Structures along Estuaries and Large Rivers
https://www.stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/ShorelineStructures.pdf

Atlantic Canada

Eastern Habitat Joint Venture: Partners Conserving Habitat for Migratory Birds
http://www.ehjv.ca/about-us/
Atlantic Canada Conservation Data Centre
http://accdc.com/index.html
Atlantic Canada Critical Habitat Data
http://data.ec.gc.ca/data/species/assess/atlantic-canada-critical-habitat-data/?lang=en

Prince Edward Island (PEI)

Provincial Wetlands https://www.princeedwardisland.ca/en/information/communities-land-and-environment/forests-fish-and-wildlife-policies-and-studies
Watercourse and Wetland Activity Permit Information
https://www.princeedwardisland.ca/en/service/apply-watercourse-wetland-and-buffer-zone-activity-permit
PEI Wildlife Management Areas (areas protected under Wildlife Conservation Act)
https://www.princeedwardisland.ca/en/information/communities-land-and-environment/wildlife-management-areas
PEI Natural Areas https://www.princeedwardisland.ca/en/information/communities-land-and-environment/natural-areas

New Brunswick (NB)

Wildlife Habitat Protection https://novascotia.ca/natr/wildlife/conserva/habitat-protection.asp

Prerequisite 3: Conservation of Critical or Sensitive Habitats — REQUIRED

Protected Natural Areas
https://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/ForestsCrownLands/content/ProtectedNaturalAreas.html
Nature Trust of NB http://www.naturetrust.nb.ca/wp/blog/environmentally-significant-areas/
Wetlands and Watercourses, lake management and protection
https://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/water.html
Coastal Areas and Shorelines https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/CoastalAreasProtectionPolicy.pdf

Nova Scotia (NS)
Agriculture Marshland Convention Act https://nslegislature.ca/legc/bills/61st_1st/3rd_read/b017.htm
Nova Scotia Nature Trust - Preserving Our Coastal Treasures (999999resources for coastal landowners):
https://nsnt.ca/our-work/focus-areas/preserving-our-coastal-treasures/
Parks and Protected Areas https://novascotia.ca/parksandprotectedareas/plan/interactive-map/
https://novascotia.ca/nse/protectedareas/
Nova Scotia's Species at Risk – Conservation and Recovery http://www.speciesatrisk.ca/
Clean Water (Coastal Restoration Projects) https://clean.ns.ca/northumberland-strait-coastal-restoration-project/
Sanctuaries and Wildlife Management Areas https://novascotia.ca/natr/wildlife/habitats/hab-data/
Wildlife Habitat and Watercourse Protection Regulations
https://novascotia.ca/just/regulations/regs/fowhwp.htm
Wildlife and Biodiversity of Nova Scotia https://novascotia.ca/natr/wildlife/

Newfoundland (NFLD)
Wilderness and Ecological Reserves https://www.flr.gov.nl.ca/natural_areas/wer/find.html
Salmon Association of Eastern NFLD https://www.saen.org/conservation.html
Protected Areas https://www.flr.gov.nl.ca/natural_areas/apa/index.html

Prerequisite 4: Riparian Zone Protection

Intent

To conserve and restore riparian vegetation and its associated ecological services such as habitat for shore species, organic input to the nearshore environment, buffering the shore from erosional processes and filtration of stormwater runoff.

Context

Shore developments can result in a reduction of riparian features and functions shown in the accompanying figure, often by clearing and levelling naturally vegetated and sloped shores in order to improve water views or create desired features such as level lawns. These 'improvements' can have deleterious impacts on site drainage, bird nesting and roosting habitat, bank stability, shading of foreshore areas by tree canopies and reduction of important organic inputs to marine and lake environments. Loss of nearshore trees can also decrease the presence of large woody debris, which provides cover for small fish, egress for waterbirds, and can help stabilize a shoreline.

The nature of the riparian zone will vary with rainfall patterns, wind exposure, the site's soils and geology and shore type. For sheltered lakes and more protected shores, the natural riparian zone often consists of a mixture of trees with overhanging canopy and salt/water tolerant shrubs. More exposed shores will have a higher proportion of shrubs and less overhanging tree canopy. Grasses and small shrubs dominate in the dryer, rocky shore areas. A preserved or restored riparian zone should, as much as is practical, reflect the natural conditions of the site and region.

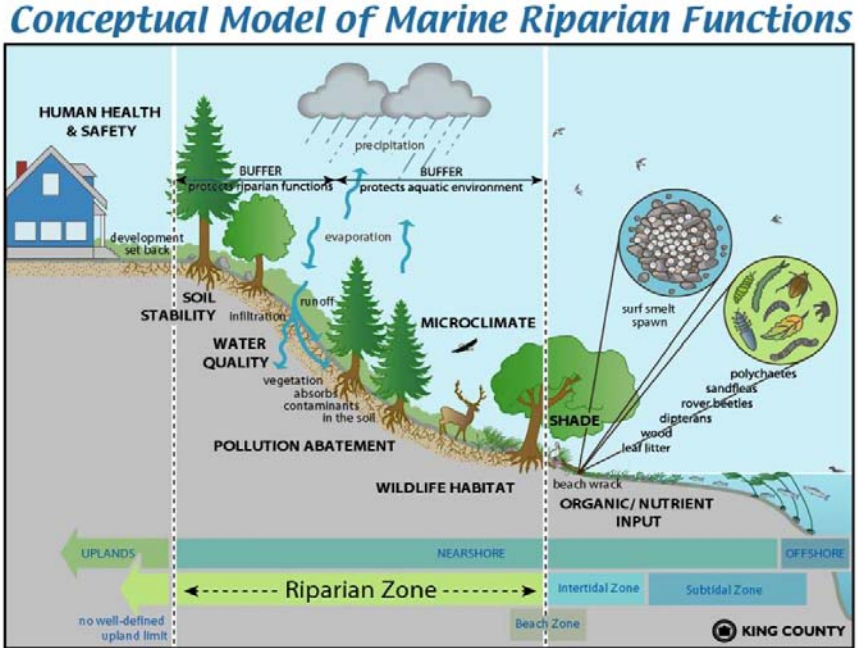


Figure 4. Marine shoreline example. Many aspects are also applicable to freshwater shorelines, without tidal influence (J. Brennan and H. Culverwell, 2004).

Prerequisite 4: Riparian Zone Protection REQUIRED

Applies to

The riparian zone/shore zone of the project area immediately landward of the NB/OHWM extending up to an immovable barrier such as road or building.

Note: Vegetation in the intertidal zone (coastal areas or reservoirs) is also a critical component of healthy shoreline ecosystems. This prerequisite does not include the intertidal zone as it is addressed in Prerequisite 3 and Credit 5.

Requirements

1. Conserve and/or restore (where needed) a natural riparian zone for a minimum width of the larger of 10m or any local requirement[13], measured as a horizontal distance landward of the NB/OHWM, over a minimum of 50% of shore length or any vegetated buffer defined by local regulations. All development activities must occur outside the designated area.
2. Where restoration is needed, it must be conducted according to a re-vegetation plan/design prepared by a registered professional biologist or registered landscape architect with experience in riparian ecosystems.
3. The plant species and design must match the natural system that is characteristic of the project site; e.g., exposed sand, rocky outcroppings, protected estuary, mudflats, coastal forest, etc.
4. If the site is a designated Park (local, provincial, national) or conservation area, all newly planted plants must be native species accustomed to the region with the larger of a minimum riparian width of 15m over at least 70% of the shore length or any vegetated buffer defined by local regulations.
5. If the project involves restoring the riparian zone, either by planting or removing invasive plants or some combination thereof, a post-construction monitoring plan is required (details in *Submittals).*

Riparian Zone Allowances

While they may physically overlap on the project site, the protected riparian zone is independent of the setback for structures required under Prerequisite 1 (i.e., the riparian zone may form part of the setback).

The riparian buffer may incorporate stormwater infiltration design objectives to meet Credit 9. However, the stormwater infiltration structures must not compromise the other ecological services provided by a riparian buffer.

The riparian prerequisite does not include aquatic re-vegetation, which is addressed in Credit 5.

[13] For example: In BC, the Riparian Area Regulation applies and is an automatic 15 m set back from lakes, ponds and wetlands, and 30 m if the property is on a south-facing shoreline. Check with local and provincial regulations to determine your setback — the more stringent rules apply.

Prerequisite 4: Riparian Zone Protection REQUIRED

Submittals

1. The appropriate Letter Template signed by a Qualified Environmental Professional indicating the local requirements for vegetated buffer width or length.
2. A scaled site plan showing the location and typical species composition of the existing riparian zone indicating the portion (minimum 50% of shore length) to be conserved and, as needed, restored. The plan, or an accompanying report, should indicate how the width of conserved riparian zone will be protected during the construction phase (fencing, signage, etc.) and which species will be used.
3. If planting is required, a vegetation or re-vegetation plan for the conserved and/or restored riparian zone prepared by a Qualified Environmental Professional, including selected plant species and landscape design.
4. Pre- and post-construction photographic documentation of the designated riparian zone.
5. A post-construction monitoring plan is required if the project includes riparian restoration (planting). The plan should assess and confirm the functionality of the restored areas. The monitoring plan must include benchmarks for habitat functionality, methods for tracking species survival after planting has occurred, viability, time frame (a minimum of three years or what is required by agencies in your region) and a financial commitment to complete the monitoring plan and implement maintenance or remedial measures if required. The monitoring plan may be combined with the vegetation plan. Conservation-only projects do not require a monitoring plan if there was no work within the riparian zone.

Site Plan Requirements
The plan should include an explanation of how the conservation and restoration measures will maintain or enhance riparian features, functions and conditions (e.g., will provide habitat of what type, stabilize loose sediments, improve water filtration, etc.).

Strategies and Technologies

- Do not extend mowed lawn areas to the top of shore embankments or bluffs. Preservation or restoration of native vegetation at the top of embankments or bluffs will stabilize banks as plant roots will hold soils and maintain shoreline bank integrity.
- Use native riparian vegetation as landscape features. Do not use ornamental, non-native or invasive species.
- Incorporate vegetation and natural resources into shore protection works, such as beach nourishment, anchored logs and riparian plantings on relatively protected shorelines where appropriate.
- Plan for an appropriate plant density in the riparian zone. Planting design should be completed and verified by a biologist or landscape architect to ensure optimal plant survival and benefit. As guidance, the project may use a planting density where plants are no further apart (on center) than:
    - Grasses and forbs: 0.3-0.6 m using 25 mm pots or 0.6-0.9 m using 3.8 litre pots or larger
    - Shrubs: 1.0-1.5 m (depending on species) using minimum 7.5 litre pots

Prerequisite 4: Riparian Zone Protection REQUIRED

- Trees: 3-4 m (depending on species) using minimum 19 litre pots
- These are generally consistent with typical riparian vegetation restoration plantings, but local specifications may vary, and plant species and site conditions can affect planting. Consult with a biologist and/or landscape architect to determine the appropriate species and planting density.

Prerequisite 4: Riparian Zone Protection REQUIRED

Resources

General

Washington Native Plant Society
https://www.wnps.org/photogallery1.html
Levings, C., Jamieson, G. (2001). Marine and Estuarine Riparian Habitats and their role in Coastal Ecosystems, Pacific Region
http://metchosinmarine.ca/gf/wp-content/uploads/2013/09/MarineRiparianHabitatsLevingsJamieson2001.pdf
The Shore Primer – How to Preserve Your Shore's True Nature
http://www.dfo-mpo.gc.ca/Library/337927.pdf
Vegetation Management: A Guide for Puget Sound Bluff Property Owners
https://fortress.wa.gov/ecy/publications/documents/9331.pdf

British Columbia

Riparian Areas Regulation (RAR) Appendix 4: Revegetation Guidelines for Brownfield Sites
https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/fish-fish-habitat/riparian-areas-regulations/rar_reveg_guidebk_sept6_2012_final.pdf
The Living by Water Project
http://www.bcnature.ca/projects/completed-projects/living-by-water/
Shoreline Landscaping – Working with Your Land
http://www.bcnature.ca/wp-content/uploads/2015/03/Section2-7.pdf
Streamside Planting Guide for Western Washington (Cowlitz Conservation District, 2001)
Shoreline Structures Environmental Design – A Guide for Structures along Estuaries and Large Rivers
https://www.stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/ShorelineStructures.pdf
Lands Near Water: Riparian Restoration and Enhancement
https://www.stewardshipcentrebc.ca/PDF_docs/sar/Lands%20Near%20Water%202018%20(Web).pdf

Atlantic Canada

Nova Scotia Guide to Altering Watercourses
https://novascotia.ca/nse/watercourse-alteration/docs/NSE-Watercourse-Alteration-Program-May29.pdf
New Brunswick Watercourse Alteration Guidelines
https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/WatercourseAlterations.pdf
Prince Edward Island Watercourse, Wetland and Buffer Zone Activity Guidelines
http://www.gov.pe.ca/photos/original/elj_webpkg.pdf
Best Management Practices for Riparian Zones in Newfoundland and Labrador
https://www.faa.gov.nl.ca/publications/pdf/nl_riparian.pdf

Prerequisite 5: Construction Environmental Management Plan

Intent

To minimize impacts of construction activity on marine and lake waters and valued, sensitive habitats and species.

Context

Construction-related sediment input to foreshore areas can cause turbidity or the introduction of contaminants. These inputs negatively impact critical life cycle stages for fish and invertebrates (particularly egg incubation). Certain plants and filter-feeding invertebrates are sensitive to increased sediment input. In addition, many contaminants are bound to sediment, so reducing sediment input also greatly reduces the risk of contaminant movement to foreshore areas. Noise can also negatively impact fish and wildlife.

Applies to

The development property and adjacent foreshore.

Requirements

Develop and follow a Construction Environmental Management Plan (CEMP) specific to the project site, to multiple contract projects within a site, and/or multiple individual properties that includes the shoreline site. The CEMP should include:

1. Sediment and erosion control during construction, including prevention of construction-related soil loss and prevention of sediment input to the receiving environment from construction-related run off and storm water.
2. Appropriate construction timing windows based on habitat use (e.g., fish presence, bird migration and breeding seasons, etc.) and precipitation (e.g., avoiding work during the rainy season).
3. Measures taken to prevent the risk of hazardous materials and contaminant spills, including oil, gas and hydraulic fluid and use of environmentally friendly materials.
4. Response plan and equipment available in the event of an accidental spill of hazardous materials.
5. Measures to prevent polluting the air with dust, smoke and other particulate matter, as applicable.

Management vs. Monitoring Plans
The Construction Environmental Management Plan is separate from the Post-Construction Monitoring Plans required in other credits and prerequisites. The CEMP address impacts that may happen *during* construction, whereas the post-construction monitoring plan monitors conditions *after* construction.

Prerequisite 5: Construction Environmental Management Plan — REQUIRED

6. Measures to minimize and control the timing of loud noises associated with construction (as with pile driving or blasting).
7. On site briefing and reporting requirements for environmental monitoring by a Qualified Environmental Professional.

The environmental management plan should incorporate appropriate elements of the federal, provincial and local regulations including but not limited to:

- Standards and Best Management Practices for Instream Works - Operational Best Management Practices for Stream Bank and Lakeshore Protection (http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf)
- Fisheries and Oceans Canada Operational Statements (http://www-heb.pac.dfo-mpo.gc.ca/decisionsupport/os/operational_statements_e.htm) for any relevant construction activity (dock construction, beach maintenance).
- Erosion and sedimentation control handbook for construction sites https://novascotia.ca/nse/surface.water/docs/ErosionSedimentControlHandbook.Construction.pdf
- Construction standards for activity in watercourses and wetlands https://www.princeedwardisland.ca/sites/default/files/publications/construction_standards_for_activity_in_watercourses_and_wetlands.pdf

Submittals

1. The applicable Letter Template signed by a Qualified Environmental Professional.
2. A copy of the CEMP with documentation that the plan adheres to the referenced Best Management Practices.
3. For constructed projects or projects under construction, copy of one or more CEMP Reports indicating compliance with the CEMP.

Strategies and Technologies

- Reduce sedimentation during the construction phase by use of silt curtains and fences, sedimentation ponds, and reduction of soil runoff by riparian plantings and hydro seeding (with native plants), stabilization of steep slopes, promotion of infiltration, and phasing of the project to minimize amount of exposed soil.
- Establish clearly defined construction boundaries so as to minimize disturbance and potential sediment run-off; fence critical or sensitive habitat.
- Schedule work at appropriate times of year to lessen disruption to fish and fish habitat (contact local DFO office for information on construction timing windows) and bird or amphibian nesting or migration periods (refer to local guidelines, manuals and regulations in your area, some of them listed below).

Prerequisite 5: Construction Environmental Management Plan — REQUIRED

- Use staked or floating silt curtains, cofferdams, in stream weirs, or settling ponds.
- Complete any in-water works by hand rather than machinery, whenever possible, as these practices have the least impact on sensitive species.
- Operate machinery in a manner that minimizes disturbance to the banks of the water body and the receiving environment (machinery in clean condition, free of fluid leaks, use of vegetable-based hydraulic fluids).
- Wash, refuel and service machinery and store fuel and other materials for machinery at least 15 m from the NB/OHWM, top of bank, watercourse or catch basin to prevent deleterious substances from entering the water.
- Keep an emergency spill kit on site and ensure that project personnel (i.e. construction crew) are properly trained in its use and in spill reporting.
- Use materials such as orange snow fencing and signage of riparian and “no-go” areas to restrict access during restoration or development.

Prerequisite 5: Construction Environmental Management Plan

REQUIRED

Resources

General

Fisheries and Oceans Canada Operational Statements for Specific Construction Activities
http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html
Slope Stabilization and Erosion Control Using Vegetation
https://fortress.wa.gov/ecy/publications/documents/9330.pdf

Erosion Control and Construction Management Sections of the Stream Stewardship Guide
http://www.dfo-mpo.gc.ca/Library/189990.pdf

British Columbia

Standards and Best Management Practices for Instream Works
http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf
Section 3 Develop with Care: Environmental Guidelines for Urban and Rural Development in British Columbia
https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/standards-guidelines/best-management-practices/develop-with-care/dwc-section-3.pdf

BC Ministry of Environment – Guidelines and Best Management Practices
http://www.env.gov.bc.ca/wld/BMP/bmpintro.html
Lands Near Water: Riparian Restoration and Enhancement
https://www.stewardshipcentrebc.ca/PDF_docs/sar/Lands%20Near%20Water%202018%20(Web).pdf
Agricultural Waterways: Drainage Maintenance and Stewardship
https://www.stewardshipcentrebc.ca/PDF_docs/sar/Agricultural%20Waterways%202018%20(Web).pdf
Environmental Best Management Practices for Urban and Rural Land Development in British Columbia
http://www.env.gov.bc.ca/wld/documents/bmp/urban_ebmp/urban_ebmp.html

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Erosion and sedimentation control handbook for construction sites (Nova Scotia)
https://novascotia.ca/nse/surface.water/docs/ErosionSedimentControlHandbook.Construction.pdf
Principles of Erosion and Sediment Control (Nova Scotia)
https://novascotia.ca/tran/works/enviroservices/ESCCourseMaterial/2_Principles_of_Erosion_and_Sediment_Control.pdf
Erosion and Sediment Control Course Materials (Study materials for contractors in Nova Scotia)
https://novascotia.ca/tran/works/enviroservices/enviroErosion.asp
Reducing Soil Erosion (New Brunswick)
https://www2.gnb.ca/content/gnb/en/departments/10/agriculture/content/land_and_environment/environmental_sustainability/soil_erosion.html
Coastal and Ocean Management Strategy and Policy Framework (Newfoundland and Labrador)
https://www.fishaq.gov.nl.ca/publications/pdf/CoastalStrategy_2011.pdf

Credits

Credit 1: Site Design with Conservation of Shore Zone

Intent

To avoid or reduce the degradation of the shore zone through site design that conserves or restores natural conditions.

Context

The basic concept behind this credit is to designate the shore zone as 'common area' that buffers development from hazards associated with the shore zone while also buffering the shore zone from impacts of development. Benefits of keeping development away from the shoreline include:

- Reduced risk of flooding, storm surge and erosion to structural and property assets.
- Opportunities to preserve, restore and/or enhance shore zone habitats and processes.
- Provides waterfront access, a highly valued community amenity, to more people rather than fewer private owners on limited frontage.
- Ability to locate common access points and facilities (e.g., docks, piers, associated lighting) in the best, lowest impact sites, avoiding the proliferation of individual facilities along the waterfront.
- Lot owners can enjoy the water view without the higher taxes typically associated with waterfront property.
- Higher aggregate property value across all properties due to increased shore access.
- Opportunities for adaptability to climate change including sea level rise.

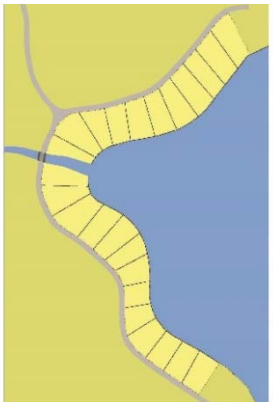

Figure 5a. Traditional shoreline subdivision:

- Larger portion of shore length directly developed
- Limited community frontage and access
- Little to no riparian buffer

Figure 5b. Community oriented shoreline subdivision:

- Larger, shared community space
- More accessibility
- Lots distanced from shore hazards and habitats

(Adapted from Lanarc Consultants Ltd by CGS)

Credit 1: Site Design with Conservation of Shore Zone 1-3 POINTS

Applies to

Site plans and designs for new development and redevelopment of a shore area including subdivisions and parks.

Requirements

1. Permanently designate a minimum of 75% of the shoreline length as a 'common area' subject to no development (other than for limited recreational use, as described below).
2. The designated area must have an average width of either the total natural projected erosion over the project lifetime, or 30m (whichever is greater), measured as the horizontal distance landward of the NB/OHWM, with a minimum width of 7.5m at any given point.

Public vs. Private Ownership

A conservation area or park may be publicly or privately owned but with the primary objective of protecting environmentally sensitive features and shoreline processes and, within those limits, provide for public access and enjoyment.

Points are awarded on the following basis:

Conservation of Shore Zone – Action by Type	Points: Public Parks	Points: Private Development
Typical urban or community area with pathways, swimming beach, and/or other non-permanent human-use amenities; minimal outdoor lighting as needed for safety	n/a	1
Nature park with controlled access, minimal human use amenities; minimal outdoor lighting	1	2
Conservation area with natural features, preservation and enhancement of native vegetation; no outdoor lighting; include areas with limited or restricted access	2*	3

*Native vegetation use is required for public parks.

Submittals

1. The applicable Letter Template signed by a Qualified Environmental or Coastal Professional.
2. A site plan and report, signed by the above qualified professional, indicating:
    - Location of the shoreline common area in relation to developed areas.
    - Designation mechanism (e.g., dedication or conservation covenant to local government, strata, non-government organization authorized to receive dedications or covenants, etc.)

Credit 1: Site Design with Conservation of Shore Zone 1-3 POINTS

- A management plan for the shore zone area indicating environmentally sensitive areas and/or critical shore features and functions and how they will be protected.
- Type and design of public amenities (e.g., common water accesses such as walkway or dock instead of allowing for construction of several individual private accesses). Public access must be designed in an environmentally sensitive manner (minimal footprint for designated use, avoid permanent damage or destruction to riparian vegetation, minimal outdoor lighting, etc., see Prerequisite 1 and Credit 2 for more details).

Strategies and Technologies

- *Clustering* – Siting lots (in the case of a subdivision) or structures (in the case of a multi-use or higher density development) or amenities (in the case of parks) away from the shore zone to create open space – see accompanying figures. Clustering may or may not entail 'density transfer' or 'density bonus' (described below).

- *Density transfer* – This refers to locating the same number of units permitted under a given zone on a portion of the development parcel to allow the other portion to be retained as open space or some other community amenity. This can be achieved through using smaller lot sizes or higher density housing or building forms; e.g., duplex, fourplex, townhome, patio home, condominium, etc. instead of detached single-family housing. Density transfer may or may not require rezoning the parcel.

- *Density bonus* – Some local governments encourage or provide incentives for clustering through density bonuses – allowing additional units beyond that which would typically be allowed under zoning requirements in exchange for additional open space over and above the amount that would normally be required. The additional open space cannot be land that would otherwise be undevelopable.

- *Development agreements, covenants* – A developer who dedicates the shoreline portion of a development parcel to a local government as a park or conservation area may wish to protect the interests of future landowners facing onto or over the shore area by negotiating provisions regarding amenities to serve future landowners (e.g., dock area) and/or protection of views (e.g., limits on built facilities, height limits, view corridors) through development agreements or covenants.

- *Conservation covenant/easement* – If the development property contains sensitive habitats or other valued ecosystem components (e.g., known salmonid rearing habitat, old growth forest, etc.) then the developer may designate those areas for a conservation covenant, a joint-ownership arrangement whereby the landowner retains many private property rights while protecting the land from future development even if the property is sold. In many cases there are tax benefits associated with conservation covenants. Check to see if this option is available in your region.

Credit 1: Site Design with Conservation of Shore Zone 1-3 POINTS

Resources

General

Conservation Design for Subdivisions – Randall Arendt
http://www.greenerprospects.com/cds.html
Smart Growth Toolkits
https://www.epa.gov/smartgrowth/smart-growth-tools
https://smartgrowthamerica.org/resources/smart-growth-implementation-toolkit/

British Columbia

Thompson Nicola Regional District Lakeshore Development Guidelines 2004
https://tnrd.civicweb.net/document/17913
BC Building Codes and Standards
https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/the-codes
Local Government Guide for Improving Market Housing Affordability in British Columbia 2005
http://www.housing.gov.bc.ca/pub/market_housing_affordability.pdf
Planning for housing, 2004: an overview of local government initiatives in British Columbia
https://www2.gov.bc.ca/assets/gov/housing-and-tenancy/tools-for-government/uploads/planning_for_housing_2004.pdf
Office of Housing and Construction Standards: Provincial Housing Strategy and Programs
http://www.housing.gov.bc.ca/housing/

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Halifax Green Network Plan (HGNP)
https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/HGNP-Final%20Report_20180726_updated.pdf
A Coastal Areas Protection Policy for New Brunswick
https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/CoastalAreasProtectionPolicy.pdf
Coastal and Ocean Management Strategy and Policy Framework (Newfoundland and Labrador)
https://www.fishaq.gov.nl.ca/publications/pdf/OceansDiscussionPaper.pdf
Policy for Development in Shore Water Zones
https://www.mae.gov.nl.ca/waterres/regulations/policies/shore_water.html

Credit 1 Case Study: Site Design with Conservation of Shore Zone – Regatta Point, NS

Design Schematic

Year Completed:

Design completed in 2018 – (Construction pending as of late 2019)

Project Team and Affiliated Organizations:

CBCL Limited

Halifax Regional Municipality

Upland Urban Planning and Design Studio

Conquest Engineering

Project Overview

A combination of wave action and increasingly higher water levels have caused damage to the sea walls and revetments along the shorelines of the Northwest Arm, near Halifax, Nova Scotia (NS). Regatta Point shorelines and walkways are located between Purcells Cove Road and the Northwest Arm, extending for approximately 1 km. The project aims to provide enhanced shoreline features including a new trail fronted by a mix of salt marshes, pocket beaches and rock revetments as appropriate. As of Fall 2019, the project was in the final design stage.

Site History

The Regatta Point Walkway is used by bikers and pedestrians and sits at the heart of a vibrant coastal community. The majority of the surrounding area is residential, multi-family apartments. The rock slopes along the Regatta Point trail are low-crested and made of undersized riprap (see image below), rendering the trail vulnerable to wave overtopping and washouts, affecting the residents and the community. When considering the forecasted effects of sea level rise and storm surges, it was determined during the design phase that the trails needed to be raised, and protection against wave attack needed to be reinforced by a mix of hard and soft approaches.

Implementation

The proposed design solutions are based on a combination of hard infrastructure in the most exposed areas and/or steep slopes, and soft infrastructure where milder wave climate and/or flatter natural slopes allow the use of infrastructure that imitates natural processes for wave dissipation and climate change adaptation. The project would protect environmentally sensitive features and shoreline processes and provide for public access and enjoyment.

Pre-project conditions

Credit 1 Case Study: Site Design with Conservation of Shore Zone – Regatta Point, NS

How the Project Addresses Credit 1 Requirements

Materials

- Design uses local sediments with characteristics suitable for use in living shorelines.
- Sand will be used to create or enhance pocket beach and marshes.
- Armour stone for the breakwaters and revetments in exposed/steep slopes only as required

Habitat Components

- Pocket beaches were designed to restore more natural conditions along the built shoreline.
- Salt marsh habitats will be re-established
- Rock slopes within the intertidal zone will be milder to reduce scour and attenuate wave energy.

Site Design with Conservation of the Shore Zone

- Development of cost-benefit assessment of shoreline stabilization options based on environmental conditions, cost, climate change adaptability, wave agitation and geomorphological conditions.
- The width of pocket beaches and marshes exceeds 30 m from the natural boundary, and the minimum width along the entire waterfront trail exceeds 7.5 m.
- The new trail shall be built at a minimum elevation equal to or exceeding the 1 in 100-year water level plus sea level rise anticipated over the lifetime of the project.
- The Regatta Point shoreline improvements will ensure the continuation and improvement of a shared common space along the entire project shoreline, while buffering the developments from coastal hazards and enhancing natural shoreline ecosystems.

Ecological Services Provided

- Creation of additional aquatic and intertidal habitat along the shoreline.
- Improved water quality and opportunity for ecological succession.
- Carbon sequestration from marshes.

Other notes

- Project also highlights Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes (Credits 4 and 5) through living shorelines and Climate Change Adaptation Plan (Credit 8).

Studio artist's rendition of final design

Credit 2: Shore-Friendly Access

Intent
To encourage appreciation of the shoreline environment by providing for private or public access to, and enjoyment of, the shoreline and foreshore in ways that avoid or minimize negative impacts to natural systems and processes.

Context
With careful site planning and design, access can be created without compromising valuable shoreline habitats at both private and public shores.

Applies to
The development property, including shore zone and upland. If there is a pre-existing access structure that meets the requirements, it is eligible for 1 point.

Requirements
Develop and implement a shore access plan for enabling site use without compromising sensitive site features (e.g., riparian buffer, backshore vegetation community, bird nesting habitat, erodible slopes, etc.), prepared by a Qualified Environmental Professional. See Strategies and Technologies for ideas on how to minimize impact.

Points are awarded on the following basis:

Access – Action by Type	Points
Existing access structure (boardwalk, path, stairs, etc.)	1
New, upgraded* or replaced access structure or design	2
Bonus: public access through private development	1

*Upgraded refers to the improvement of an existing access structure such that it meets or exceeds the requirements in this section.

Submittals

1. The applicable Letter Template signed by a Qualified Environmental Professional.
2. A signed and scaled site plan and accompanying report indicating how the following objectives will be achieved:
    - Clear entrances/gateways
    - Well defined public spaces
    - Protection of ecological services and features and physical processes, as applicable
    - Appropriate wayfinding and signage

Credit 2: Shore-Friendly Access 1-3 POINTS

Strategies and Technologies

- On steeper terrain select only the safest access points and routes (e.g., rocky shores and bluffs)
- Incorporate well-designed and drained trails, to encourage their use over trampling elsewhere along the shoreline
- Design boardwalks where crossing sensitive ecosystems such as wetlands, sensitive dune-grass ecosystems, sparsely vegetated coastal bluffs, etc. as necessary, using the narrowest crossing location
- Where possible, use permeable or semi-permeable materials (e.g., hatching or stones) for walkways and platforms instead of impermeable materials (e.g., pavement)
- Provide fencing (e.g., pagewire) that limits the access of dogs to sensitive habitats and shorelines. Use these tools to guide dogs to specific areas for drinking, swimming, and other water activities.
- Engage a Qualified Coastal Professional throughout the design process for steep or erodible sites

Figure 6. Example of a shore access trail, West Vancouver, BC. Backshore and riparian areas are present and there are clearly marked paths. This access could be improved with permeable materials (instead of pavement) and more fencing to protect riparian areas (Coastal Geologic Services, Inc.).

Credit 2: Shore-Friendly Access 1-3 POINTS

Resources

General

Fraser River Action Plan, 1998. *Access Near Aquatic Areas: A Guide to Sensitive Planning, Design and Management*. Ministry of Environment, Lands and Parks, Habitat Protection Branch. 82 p.
http://stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/access.pdf

Fisheries and Oceans Canada Operational Statements for dock and boathouse construction
http://www.klsb.org/wp-content/uploads/2012/11/Appendix-B_1.pdf

Green Shorelines: Bulkhead alternatives for a healthier Lake Washington
http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpdp025742.pdf

Access Near Aquatic Areas – A guide to sensitive planning and design (freshwater focus, by approaches and principles and applicable to marine shores)
http://www.dfo-mpo.gc.ca/Library/213410.pdf

British Columbia

Coastal Shore Stewardship: A Guide for Planners, Builders and Developers
https://stewardshipcentrebc.ca/portfolio/coastal-shore-stewardship/

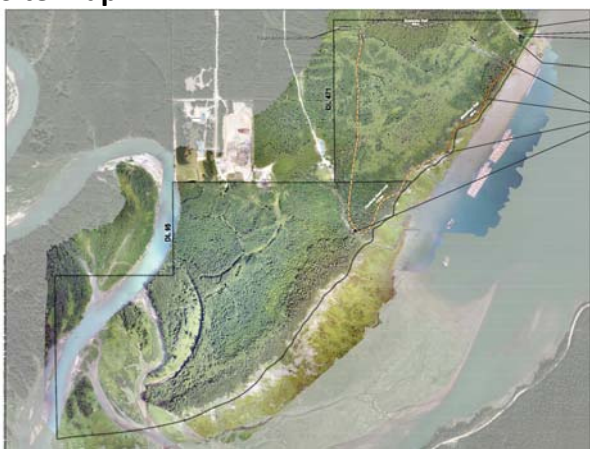
Shoreline Structures Environmental Design: a guide for Structures along Estuaries and Large Rivers. 2002
https://www.stewardshipcentrebc.ca/PDF_docs/StewardshipSeries/ShorelineStructures.pdf

Atlantic Canada

Climate Change and Shoreline Protection (Atlantic Climate Adaptation Solutions Association, 2011)
http://www.csrpa.ca/wp-content/uploads/2017/11/climate_change_and_shoreline_protection_in_atlantic_canada_0.pdf

Credit 2 Case Study: Shore Friendly Access – Minette Bay, BC

Site Map



Year Completed: Phase 1 Concept Plan presented in August 2017

Project Team and Affiliated Organizations:

District of Kitimat
Haisla Nation Lands and Resources Department
Urban Systems
Silverwood Consulting
Kleanza Consulting
McElhanney
Archipelago Marine Research
Murdoch de Greeff Landscape Architects
LM Forest Resource Solutions

Project Overview

The project site is located along the west side of Minette Bay, south of the town of Kitimat. The Minette Bay West project aims to establish community access to the ocean to promote recreation and sense of place while retaining and restoring natural habitats. For decades, community members of the District of Kitimat have desired more recreational opportunities and access to the shoreline; they were living in a coastal town with few coastal amenities. The project is intended to address this shortcoming by creating accessible pathways, hiking trails, picnic shelters, non-motorized water access, and more.

Site History

Minette Bay was the site of frequent logging activity between the 1950s and 1970s and is currently regenerating. The existing causeway was constructed in the 1960s to support log dumping and booming. The project area also contains a protected historical site as well as lands and resources owned by local First Nations communities. Since the 1950s, the Minette Bay area has been consistently identified as having recreation potential; proposals have ranged from installing a golf course to boating. However, public opinion has highlighted the importance of preserving natural areas and cultural resources.

Implementation

The Phase 1 Project Plan proposes three options for the vision of Minette Bay development: Option 1 maximizes environmental protection and places more restrictions on recreation uses; Option 3 maximizes recreational opportunities; Option 2 is intended to be a balance. The plan is currently in review by the District of Kitimat.

The Concept Plan was created with five guiding principles in mind:

1. Integrate and balance community desires, site investigation findings and Green Shores principles and guidelines
2. Minimize risk of human/bear encounters
3. Preserve sensitive areas and bear habitat
4. Concentrate use in pre-disturbed areas
5. Recognize the causeway as a focal point and landmark feature

Credit 2 Case Study: Shore Friendly Access – Minette Bay, BC

How the Project Addresses Credit 2 Requirements

Improved Public Access and Involvement

- Concept plan contains public access rationale and features signage, accessible trails and structures.
- Extensive public outreach and involvement shaped the project from the beginning.
- Public access is provided through a privately owned road.

Habitat Components and Vegetation Management

- Revegetation of Daudet creek area (cleared for fisheries creek realignment project).
- Incorporated a grizzly bear study to identify ways to protect bear habitat and minimize human/bear encounters.
- Design would include a detailed planting plan to enhance riparian areas and maintain trees for human safety while preserving grizzly bear and other wildlife "lines of sight."

Design Notes

- Design buildings and amenities to have the least amount of impact on water quality, wildlife, and intact ecosystems.
- Incorporate First Nations cultures into design of amenities, with First Nations involvement.
- Use gravel walkways to minimize infrastructure.

Protected Ecological Services

- Limit human access to the most pre-disturbed areas.
- Protect registered historical sites and areas with "archaeological potential."
- Use existing causeway structure to avoid further impact to sensitive shorelines.
- Restrict off-leash dogs from sensitive habitat areas; restrict motorized vehicle use.

Other Notes

- Project scored well for Outreach and Public Education (Credit 10) through extensive signage and ongoing opportunities for public involvement, such as site cleanups and interpretive programs.

Excerpts from the Minette Bay West Concept Plan, showing visualizations of potential park use and amenities. Note that this project has not yet been implemented; these images are illustrative only.

Credit 3: Re-Development of Contaminated Sites

Intent[14]

To remediate degraded waterfront sites where development is complicated by environmental contamination. Re-development of these areas will reduce pressure on undeveloped land and help reverse existing impacts to shores, particularly with respect to contaminant input.

Context

Contaminated sites are generally managed by the provinces. For example, in British Columbia, the Contaminated Sites Regulation defines a contaminated site as **an area of land in which the soil or underlying groundwater or sediment contains a hazardous waste or substance in an amount or concentration that exceeds provincial environmental quality standards.** Under the Regulation, the Province maintains a registry of contaminated sites and the status of their remediation as well as sites under investigation. The Environmental Management Act and Contaminated Sites Regulation also specify standards for acceptable remediation.

In Nova Scotia, the only Atlantic Canadian province with defined contaminated sites regulation, the Nova Scotia Environment (NSE) Contaminated Sites Regulations are triggered if **a substance or substances are present in soil, groundwater, sediment, or surface water at concentrations exceeding the Tier 1 Environmental Quality Standards (EQS) in the Notification of Contamination Protocol**. Under the Regulation, the Province also maintains a registry of contaminated sites and the status of their investigation or remediation progress as well as sites which are being risk managed. The Environment Act and Contaminated Sites Regulations also specify standards for acceptable remediation/risk management resulting in conditional or unconditional environmental closure of the site.

The Federal Government regulates contaminated sites on federal Crown lands and non-federal contaminated sites for which the federal government has accepted some or all financial responsibility. Federal policy defines a contaminated site as **"one at which substances occur at concentrations (1) above background (normally occurring) levels and pose or are likely to pose an immediate or long term hazard to human health or the environment, or (2) exceeding levels specified in policies and regulations."**

There may be property cost savings as well as tax incentives to choosing to develop on previously contaminated sites.

Applies to

All upland and foreshore within the property boundary of the proposed development.

[14] The intent of this credit is equivalent to the LEED contaminated site credit (e.g., SS Credit 3, LEED Canada-NC 1.1) and any site qualifying for this credit under LEED v.4 (2018) would automatically obtain the Green Shores credit.

Credit 3: Re-Development of Contaminated Sites — 2 POINTS

Requirements

Develop on a contaminated site and provide remediation as required by provincial or federal contaminated site standards, whichever apply to the parcel.

Points are awarded on the following basis:

Is It a Contaminated Site?

This credit can apply to sites which are not officially classified as contaminated, but which meet provincial or federal criteria for a contaminated site.

Contaminated Sites - Action	Points
Remediation of contaminated site	2

Submittals

1. The applicable Letter Template signed by a Qualified Environmental Professional with direct experience in contaminated site assessment and remediation.
2. Letter from the relevant regulatory agency, or an independent environmental firm confirming that the site is or was classified as contaminated

   OR

   If the site is not officially classified as contaminated, a letter or report from the relevant regulatory agency or an independent environmental assessment firm indicating that the site meets some or all of the criteria for a contaminated site.
3. Letter from the project engineer or party responsible for the remediation that remediation has been completed to the appropriate standard.

Strategies and Technologies

Under various provincial regulations, developers would use a variety of generic and site-specific factors to decide whether a site is legally considered to be contaminated. In Nova Scotia, developers use the NSE Tier 1 EQSs to determine this, which would trigger the Notification of Contamination protocols. If it is determined that contamination must be addressed, developers have the ability to choose from generic or risk-based standards when undertaking remediation.

On Federal lands, remediation measures are determined according to a step-by-step process, beginning with a rough estimate of the contamination based on guidelines adopted by the Canadian Council of Ministers of the Environment (CCME). The final stage in the procedure process is an Environmental Site Assessment that uses field sampling and laboratory analysis to determine the type and level of contamination present.

Specific strategies for remediation include pump-and-treat, bioreactors, land farming, capping and various forms of in-situ remediation.

Credit 3: Re-Development of Contaminated Sites 2 POINTS

Resources

General

Canada – Federal Contaminated Sites Inventory
http://www.tbs-sct.gc.ca/fcsi-rscf/home-accueil.aspx?Language=EN&sid=wu12213546663
The Canadian Council of Ministers of the Environment (CCME) – Contaminated Sites Publications
http://www.ccme.ca/publications/list_publications.html#link4
Environment Canada – Canadian Environmental Quality Guidelines at a Glance (water, soil, sediment and tissue residue)
http://ceqg-rcqe.ccme.ca/en/index.html
CCME – Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for Contaminated Sites in Canada (two links)
https://www.ccme.ca/files/Resources/csm/pn_1197_e.pdf
https://www.ccme.ca/en/resources/contaminated_site_management/remediation-objectives.html
Washington State Department of Ecology (WDOE) Sediment Management Standards, 2013
https://fortress.wa.gov/ecy/publications/publications/1309055.pdf

British Columbia

BC Contaminated Sites Regulation
http://www.qp.gov.bc.ca/statreg/reg/E/EnvMgmt/EnvMgmt375_96/375_96.htm
Ministry of Environment – Land Remediation Section (formerly Contaminated Sites)
https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation
A Compendium of Working Water Quality Guidelines for British Columbia (including Working Guidelines for Sediment)
http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html

Atlantic Canada

Contaminated Sites Regulations for Nova Scotia
https://novascotia.ca/just/regulations/regs/envcontsite.htm
Environmental Quality Standards for Contaminated Sites: Rationale and Guidance Document for Nova Scotia (2014)
https://novascotia.ca/nse/contaminatedsites/docs/EQS-Contaminated%20Sites-Rationale-and-Guidance-NSE-2014.pdf

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes

Intent

To reverse the negative impacts of existing shore developments on longshore sediment transport and tidal flow processes. This credit focuses only on restoration or enhancement of processes. Restoration of measurable habitat areas is addressed in Credit 5.

Context

Many existing developments have altered sediment supply to the shore and longshore sediment transport. This adversely affects adjacent and nearby down-drift properties and shoreline habitats. Impacts to shoreline processes are most often caused by hardened shores, dykes, groynes and breakwaters (collectively called "armour"). The further a structure infringes on the intertidal zone (or below the NB/OHWM) the greater the impacts to sediment processes associated with the structure. Cross-shore processes including sediment transport and the exchange of water and nutrients are often impacted by these same structures. In many cases, the type and extent of shore armour and other structures may be excessive for the site and re-development offers the opportunity to restore or enhance shoreline sediment supply and longshore transport as well as valued shoreline habitat features (see Credit 5).

Restoration is the act of returning a natural shore process to a close approximation of its pre-disturbance state in terms of structure

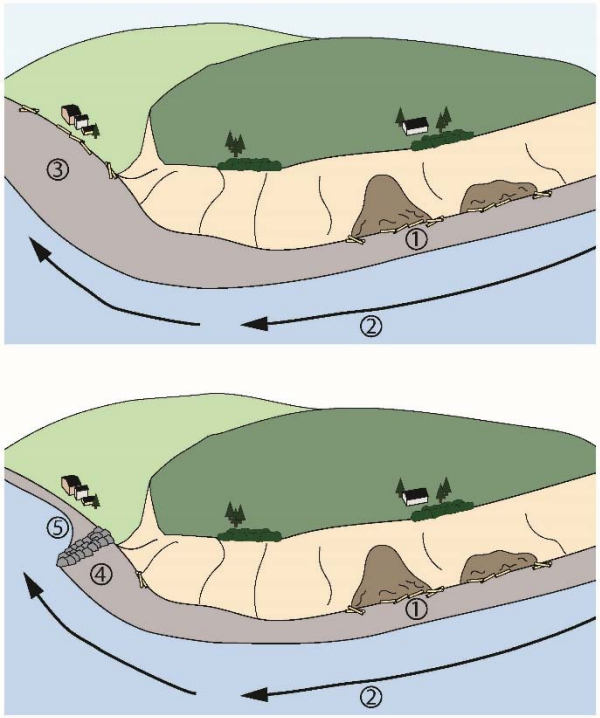


Figure 7. Changes in a drift cell after construction of a groyne (Coastal Geologic Services, Inc.)

1. Naturally eroding bluff material is deposited at base of bluff.
2. Wave action in the direction of littoral drift moves eroded sediment down the beach.
3. The sediment sustains down-drift beaches.
4. A groyne or other cross-shore structure can block sediment transport to the leeward beach
5. As a result, the beach width narrows and endangers structures.

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes — 2-9 POINTS

and function[15]. This includes measures needed to protect and preserve restored ecosystems in perpetuity (CGS, 2014)[16].

Enhancement generally refers to any improvement of a structural or functional attribute of an ecosystem (CGS, 2014).

In many cases, the most effective restoration/enhancement may encompass a larger area than the project shore, as shore processes occur on a shore reach or drift cell scale. Applicants are encouraged to partner with adjacent property owners, wherever possible and appropriate, to enable a more effective and economical restoration/enhancement effort.

Figure 8. Examples of groynes: rock structure (left), overwater building (right). Both structures trap littoral sediment transport and reduce the volume of sediment that is able to bypass the structure (Coastal Geologic Services, Inc.).

Applies to

The development property (both upland and foreshore), with consideration of shoreline processes beyond the property boundaries.

Requirements

Demonstrate the restoration and/or enhancement of longshore and/or across shore sediment processes, either through removal of existing structures, provision of beach nourishment sediment or other means.

[15] The National Research Council, 1992. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academies Press, Washington, DC.
[16] Johannessen et al., 2014. Marine Shoreline Design Guidelines. Washington Department of Fish and Wildlife, Olympia, WA.

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes

2-9 POINTS

Points are awarded for specific actions on the following basis, which can be additive for each type of action, to a maximum of 9 points:

Restoration of Processes - Action	Points
1. Sediment source bluff restoration (armour removal at the toe of sediment source bluffs) along 50-75% length of sediment source bluff on parcel (2 points) OR Sediment source bluff restoration (armour removal at sediment source bluffs) along 76% or more length of sediment source bluff on parcel (3 points)	2-3
1. Remove or modify* groynes, dykes or causeways, or other longshore transport barriers affecting 50-75% of shore length (2 points) OR Remove or modify groynes, dykes or causeways, or other longshore transport barriers affecting 76% or more of shore length (3 points)	2-3
2. Removal of tidal flow barriers (e.g., fill or tide gates) to create or restore lagoons or salt marshes	3

*Modification of groynes may in some cases be appropriate if it permits or increases passage of sediment moving alongshore if total removal is not possible.

**Points for armour (bulkhead, seawall, or riprap on shoreline) or groyne removal can be awarded only once under Credits 4 and 5 if appropriate. For example, if armour removal results in rehabilitation of shoreline process as well as degraded habitat, points will only be awarded under Credit 4.

Note that if the OHWM/NB (or HHWLT if other measures are not available) shoreline is made longer within the site as the result of the project, this will add shoreline length to compare to pre-project length for determination of credits, but only for areas to which the points apply. For example, if removal of a tidal barrier increases the high-water shore length by restoring or creating a lagoon, this would not benefit or apply to sediment source bluffs (see the New Brighton Park Case Study for an illustration of shoreline lengthening).

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes — 2-9 POINTS

Submittals

1. A Letter Template signed by the Qualified Coastal Professional. This letter should include a description of dominant wave direction and currents as well as map showing the littoral cell around the site.
2. The Prerequisite 2 submittal amended to also include:
    - A design plan that outlines the restoration/enhancement initiative and the effect of the initiative on coastal sediment transport (using the description of coastal sediment balance and pathways provided in Prerequisite 2).
    - Photographic documentation of the site before and after restoration/enhancement.
    - A section in the post-construction monitoring plan which outlines remedial actions if the restoration does not achieve its objectives.

Strategies and Technologies

- Removal of pre-existing barriers such as bulkheads (seawalls), dykes or riprap protection, especially those that are no longer functioning as intended or are treated with toxic chemicals.
- Removal or modification of existing bulkheads (seawalls) and riprap embankments and restoration of a naturally sloping, vegetated shore.
- Removal or modification of existing piers, groynes, dykes, causeways, or other structures that impede longshore or cross shore sediment movement, or modification to allow future sediments to bypass the obstacle.
- Use of sacrificial sediments to restore sediment supply to areas of shore where supply has been impeded by structural development.

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes

2-9 POINTS

Resources

General

Marine Shoreline Design Guidelines
https://wdfw.wa.gov/publications/01583/
Shoreline Management and Stabilization Using Vegetation
http://www.greenbeltconsulting.com/
Review of Alternative Shore Stabilization Projects in Puget Sound
https://salishsearestoration.org/images/b/b2/Gerstel_%26_Brown_2006_alternative_shoreline_stabilization.pdf
Alternatives to Bulkheads
http://www.ecy.wa.gov/programs/sea/pugetsound/building/bulkhead.html
Green Shores Case Studies – Bulkhead Removal
http://stewardshipcentrebc.ca/Green_shores/case-studies/
Mitigating Shore Erosion on Sheltered Coasts
http://www.nap.edu/catalog/11764.html
Controlling Erosion Using Vegetation
https://fortress.wa.gov/ecy/publications/SummaryPages/9330.html
Marshes Are the New Beaches: Integrating Sediment Transport into Restoration Planning
https://link.springer.com/content/pdf/10.1007%2Fs12237-019-00531-3.pdf

British Columbia

Aggregate Operators Best Management Practices Handbook
https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/contracting-with-the-province/documents/12808-2018/9-aggregate-operators-best-management-practices-bc-2002.pdf

Atlantic Canada

Strategic decision making for managed realignment of agricultural marshlands
https://adaptationcanada2016.ca/wp-content/uploads/2016/04/W3B-van-Proosdij.pdf
Coastal Erosion and Climate Change
http://www.csrpa.ca/wp-content/uploads/2017/11/coastal_erosion_and_climate_change_0.pdf
Geomorphic Shoreline Classification of Prince Edward Island
http://www.gov.pe.ca/photos/original/shoreline_pei.pdf
Coastal Erosion in New Brunswick, Trends and Consequences
https://www2.gnb.ca/content/dam/gnb/Departments/en/pdf/Minerals-Minerales/Coast_Cote.pdf

Credit 4 Case Study: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes – Jericho Beach, BC

Design Schematic

Year Completed: 2017

Project Team and Affiliated Organizations:

Vancouver Parks Board
Moffatt & Nichol
Raincoast Applied Ecology
Sharp & Diamond Landscape Architecture, Inc.
Sumas Remediation
Vancouver Pile Driving
City of Vancouver

Project Overview

The project site is located at Jericho Beach, near Point Gray and west of Kitsilano, in Vancouver, B.C. Located between two rock groynes, the site has very little sediment input from and transport to adjacent beaches. The objective of the project was to demolish the Jericho Marginal Wharf to improve sediment supply and public safety, to restore the natural beach and foreshore, and to remove creosote piles and concrete debris from the intertidal zone. The project was intended to enhance forage fish spawning substrate, support aquatic species recolonization, and restore the marine riparian ecotone from dune strand to forest vegetation communities. The park encompasses approximately 1 hectare and spans 175 metres in length. Enhancements were applied along approximately 86% of the shoreline.

Site History

The Jericho Marginal Wharf was built in the 1930s to serve the needs of the Royal Canadian Air Forces amphibious aircraft operations. Jericho and neighbouring La Carno beaches are some of the most popular recreational beaches in the City of Vancouver. The site offers numerous public recreational activities including jogging, sailing, beachcombing, and picnicking.

Implementation

Due to its location within a popular Vancouver park, a rigorous public engagement process with multiple stakeholders was used to build support for wharf removal and shoreline restoration. The site design promoted ecological restoration in an urban waterfront context.

The presence of toxic creosote from the wharf and pilings that supported the structure necessitated extensive sedimentation and pollution control measures in the project's Environmental Protection Plan. As many piles as possible were removed during low tide to minimize mobilization of toxins and contaminated sediment; small debris was captured with tarps, booms and hand removal; absorbent booms and pads were used to capture hydrocarbons.

Credit 4 Case Study: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes – Jericho Beach, BC

How the Project Addresses Credit 4 Requirements

Habitat Components

- Enhancement of foreshore habitats and beach elevations through beach nourishment.
- Habitat restoration plan including substrate enhancement for forage fish spawning, vegetation planting, and construction methodology (habitat restoration applies to greater than 25% of the site).
- Extensive planting plan designed by a registered professional biologist with extensive experience in coastal riparian systems. The planting plan was applied along 30 meters of the project site and included the conservation of healthy riparian areas and extensive new plantings.
- Concrete debris removed from intertidal to uncover beach substrate and habitat.

Restoration of Coastal Sediment Processes

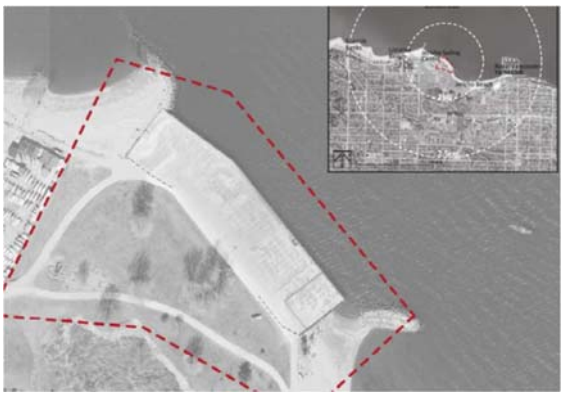
- Removal of pre-existing wharf with bulkhead and fill landward of wharf.
- Some rock was used to stabilize the soft shore protection, so the site is not entirely free of armour.
- Removal of piles may restore the natural wave regime at the site; it was not determined if the groynes could be breached during storms to resume (eastward) sediment transport from the site.
- Multi-year monitoring plan was submitted to assess the functionality of the restored habitats.
- Potentially restored sediment transport rates from removal of dense creosote piles.

Ecological Services Provided

- Creation of additional intertidal and riparian habitat with an additional 150 meters of shore length.
- Bulkhead removed to restore marsh habitat.
- Restored buried surf smelt and sand lance spawning habitat and enhanced adjacent habitats.
- Marine riparian vegetation enhancement provided additional shade and refuge for migrating juvenile salmonids and other smaller fish, water pollution abatement, and increased resilience to sea level rise.

Other Notes

- Project scored well for Restoration/Enhancement of Shoreline Habitats (Credit 5) and for Climate Change Adaptation (Credit 8) as structures were moved landward of the projected future location of the natural boundary, soft shore protection was used to mitigate erosion, and marine riparian buffers were sited at higher beach elevations.



Before

After

Credit 4 Case Study: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes – Sudden Valley Marina, WA

Sudden Valley Marina, 2018 (Google Earth; before)

Year Completed: 2019

Project Team:

Wilson Engineering

Coastal Geologic Services Inc.

JA Brennan and Associates

Sudden Valley Community Association

Project Overview

The project site is located on the west shore of Lake Whatcom in Whatcom County, Washington State, in the US. Lake Whatcom is just over 2,000 hectares and has numerous residential waterfront lots as well as parks and more natural areas. The Sudden Valley Marina beach restoration project removed failing hard shore armour from a portion of the shoreline and utilized beach nourishment to stabilize the east wing of the marina.

Site History

Sudden Valley Marina was built in the 1970s. The marina is owned and managed by the Sudden Valley Community Association and features wet and dry moorage as well as boat launch areas for residents. The marina is composed of two curved, artificial "peninsulas" on its east and west side that were formerly protected with a combination of wooden soldier pile walls, vinyl sheet pile walls, and stacked automobile tires. These structures were experiencing sagging, displacement, and degradation, which led to bank erosion, and they precluded the natural transfer of nutrients and sediments between the uplands and the lake bed.

Implementation

Site investigations were initiated in 2017, followed by feasibility analyses exploring four alternatives that led to a design in 2018. Armour removal with beach nourishment was selected as the final design approach. This required cooperation and communication between Sudden Valley residents, the Community Association, several consulting firms and the Whatcom County planning department to ensure a successful project that balanced habitat and recreational benefits. The project resulted in the removal of approximately 183 meters of failing armour and the enhancement of approximately 216 meters of lake shore habitat with beach nourishment. The project was completed in early 2019.

Vinyl sheet pile wall was a barrier to sediment transport and connectivity prior to removal. Upland uses were maintained.

Credit 4 Case Study: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes – Sudden Valley Marina, WA

How the Project Addresses Credit Requirements

Materials

- Fill and old hard armor removed, including failing vinyl sheet pile wall, dilapidated wood cap and piling.

Shoreline Sediment Restoration Components

- Removal of fill and bulkhead in two areas to restore transfer of nutrients between uplands, enhanced beach, and lakebed.
- Shore and lawn edge were pulled landward.
- 1,193 metric tons of gravel beach nourishment one primary and small areas.

Design and Construction Notes

- A comprehensive design plan explaining habitat benefits through multiple project alternatives.
- Construction was performed in the winter when (controlled) lake water levels were the lowest, to prevent certain sediment from entering the lake water.

Ecological Services Provided

- Removal of cracking vinyl material, treated wood and large rubber tires from the lake shore and shallow lakebed eliminated source of debris.
- Increase overall ecological function for fish, macroinvertebrates, and smaller lake organisms.
- Removal of wall allows for greater connectivity with increased transfer of nutrients between the uplands and the aquatic environment.

Other Notes

- This project also scored well for Restoration/Enhancement of Shoreline Habitats (Credit 5) through creation of a more natural gravel beach and Shore-Friendly Access (Credit 1) through the removal of a steep, high wall allowing for a walkable beach.
- Riparian planting areas were initially included but were substantially reduced for budget reasons.

Before

After

Credit 5: Restoration/Enhancement of Aquatic Habitats

Intent
To recover ecosystem features, functions and specific aquatic habitat areas by restoring or creating highly valued aquatic habitats, including critical or sensitive habitats.

Context
This credit is applicable to sites where previous development has impacted pre-existing conditions, including critical or sensitive aquatic habitats. This credit cannot be applied to sites with intact aquatic shoreline habitats that are otherwise in a natural state, which should be left undisturbed. At many sites, pre-existing conditions are often unknown or, if known, restoration to pre-existing conditions is not always feasible. For these reasons, the number of points awarded for this credit is based on the area and functional value of the restored or enhanced aquatic habitat, rather than the extent of pre-existing habitat restored.

The restoration or enhancement actions should focus on degraded or lower value habitat areas as it is not the intent of this credit to place restoration works over existing functional natural habitat. For this reason, it is important for the submittal report to document pre-existing habitat conditions at the restoration/enhancement sites and compare proposed action areas to pre-existing conditions.

Examples of critical or sensitive aquatic habitats and potential sources of degradation include:

- Coastal lagoons and saltmarshes have often been degraded or completely altered in many urban, dyked and other areas. These habitats are of high value for juvenile fish and other organisms for forage and refuge.[17,18]
- The foreshore, particularly in ports and harbours, may be degraded from historic upland or in-water activities such as placing fill, marinas, dockyards, and log booms.
- Lake shores that contain a mix of aquatic vegetation types and gradients, which may have been degraded by the placement of fill and development.
- Storm drains and industrial outfalls (often at some distance from the site) may be sources of ongoing contamination of aquatic habitats.

This credit is only applicable to degraded areas where the source of degradation has been eliminated or contained. For example, some foreshore areas are located adjacent to contaminated uplands where contamination of the foreshore results from leaching from the upland site or areas where dykes have been realigned. In these cases, receipt of this credit

[17] Fresh, 2006. Juvenile Pacific Salmon in Puget Sound. US Army Corps of Engineers, Seattle, WA
[18] Schlenger et al., 2011. Strategic Needs Assessment: Analysis of Nearshore Ecosystem Process Degradation In Puget Sound.

Credit 5: Restoration/Enhancement of Aquatic Habitats — 1-8 POINTS

depends on successful remediation of the upland in order to ensure that the source pathway(s) of contaminants or degrading material(s) to the foreshore have been arrested. The credit also may be received for restoration of historical degradation, such as log booming, that is not related to the adjacent upland.

Applies to
Foreshore areas including subtidal and intertidal areas (littoral and seasonally wetted areas in lakes) where aquatic habitats can be substantially restored or enhanced through direct actions within measurable areas.

In the case of contamination leaching from upland sites, this credit may be applied after off-site contaminant sources have been halted or reduced such that any on-site restoration or enhancement measures will have a higher benefit.

In certain cases, enhancement of critical or sensitive aquatic habitat in areas extending beyond the development property boundary will be considered for this credit, if assurances can be made through covenants or other means that these restored/enhanced areas will be maintained during future development.

Requirements
1. Develop and implement a habitat plan for the restoration, enhancement, or creation of aquatic habitats in foreshore areas.
2. Develop a post-construction monitoring plan to assess and confirm the functionality of the restored, enhanced, or created aquatic habitats.

The number of credit points awarded depends on the extent and type of aquatic habitat restoration.

Note that if the OHWM/NB (or HHWLT where others are not available) shoreline is made longer within the site as the result of the project, measures for determination of credits will be compared against the pre-project shore length.

Addressing Contaminated Sediments

If the restoration plan includes addressing contaminated sediments, include a letter from the relevant regulatory agency confirming that the site is classified as contaminated or provide documentation of the nature and level of contamination.

Credit 5: Restoration/Enhancement of Aquatic Habitats — 1-8 POINTS

Restoration of Aquatic Habitat - Actions	Points
1. Includes direct foreshore habitat enhancement adjacent to 10-20% of the site shoreline length* below NB/OHWM (1 point) (OR) Includes direct foreshore habitat enhancement adjacent to 20-50% of the site shoreline length below NB/OHWM (2 points) (OR) Includes direct foreshore habitat enhancement adjacent to greater than 50% of the site shoreline length below NB/OHWM (3 Points)	1-3
2. Includes direct lagoon or marsh habitat enhancement	1
3. Includes creation of critical or sensitive habitat, where appropriate	1
4. Includes removal of a pre-existing armour (seawall, bulkhead, or riprap) along 50% or more of the site NB/OHWM shore length, if this action has not already received credit under Credit 4	3

* The shoreline length is measured using the pre-project length of the NB/OHWM within the entire project area.

Submittals

1. The Letter Template signed by a Qualified Environmental Professional.
2. Signed site plan prepared to scale showing:
    - Pre-existing conditions of the foreshore and aquatic habitat restoration area(s) within the development site.
    - Type, location, area, elevation relative to geodetic or chart datum, and shore length of aquatic habitat created or restored.
3. Short narrative report outlining the objectives of the aquatic habitat restoration and the strategies and technologies used to implement the restoration (including photographic documentation of pre- and post- rehabilitation conditions).
4. Post-construction monitoring plan that outlines measures used to assess and confirm the functionality of the restored or created aquatic habitats, including remediation actions if performance thresholds are not met. The monitoring plan must include benchmarks for habitat functionality, including viability, time frame and a financial commitment to complete the monitoring plan and implement maintenance or remedial measures if required.

Credit 5: Restoration/Enhancement of Aquatic Habitats — 1-8 POINTS

5. If the project required contamination remediation (upland off-site or on-site), this remediation must be documented. See Credit 2 Submittals.

Strategies and Technologies

Restoration of marine foreshores is not a common practice in Canada, and strategies and technologies are evolving. General strategies include removal of fill and structures, sometimes requiring capping of degraded material. Removal requires that degraded material is not re-mobilized and dispersed during storms or other conditions that may occur during construction. In intertidal areas, removal is generally done at low tide, when the sediments are dry, and during appropriate operational windows to minimize impacts to marine resources and wildlife. Capping requires careful consideration of the type and amount of material to ensure that the material remains in place for the service life of the project or until natural sedimentation provides an appropriate cover of the degraded material. Choice of capping material also requires consideration of the value of the material as fish habitat, including the nature of any associated benthic community. A number of specific suggestions follow. These options should be assessed at a site and regional level by a Qualified Coastal Professional:

- Removal of bulkheads and riprap embankments to provide opportunities for remediation of intertidal marsh, beach, backshore and adjacent riparian habitats.
- Realignment of dykes in macrotidal estuaries.
- Establish sand and fine gravel beaches for spawning by forage fish (e.g., sand lance and surf smelt).
- Dune grass plantings and other native backshore vegetation can be incorporated into sandy beach and gravel berms to enhance habitat values.
- Incorporate salt or brackish marsh terraces into the shore where conditions permit.
- Wetlands restoration can be coupled with innovative stormwater treatment systems; however, wetlands should not take the place of stormwater treatment systems.
- Add appropriately sized rock at key subtidal elevations to enhance algal vegetation, including canopy kelps (e.g., bull kelp and giant kelp), where present.
- Eelgrass (*Zostera*) beds can be restored by transplanting or seeding, and may require additional substrate, where conditions permit.
- Evaluate the distribution and frequency of ice formation and its potential effect on the restoration site.
- For projects in the Bay of Fundy, include marsh body authorities. Notably, dyke re-alignment recreates critical habitat such as tidal wetlands. This important soft engineering approach has regulatory requirements due to land behind the dyke and landowners constituting a ‘marsh body’. In Nova Scotia, for example, it is governed by the Nova Scotia Marshlands Conservation Act.

Credit 5: Restoration/Enhancement of Aquatic Habitats

1-8 POINTS

Resources

General

Coastal Zone Canada
www.coastalzonecanada.org
Cold Regions Living Shorelines (online community knowledge base and forum)
https://www.ccadaptation.ca/en/crlscop
Eelgrass Wetlands
https://www.wcel.org/publication/protecting-british-columbias-wetlands-citizens-guide
Transplants
http://seagrassconservation.org/wp-content/uploads/2015/01/communities_connecting_2.pdf
Natural and Structural Measures for Shoreline Stabilization
https://coast.noaa.gov/data/digitalcoast/pdf/living-shoreline.pdf
Natural and Nature-Based Flood Management Guidelines
http://envirodm.org/post/army-corps-plans-natural-and-nature-based-flood-management-guidelines
Principles and Guidelines for Ecological Restoration in Canada's Protected Natural Areas
https://www.pc.gc.ca/en/nature/science/conservation/ie-ei/re-er/pag-pel

British Columbia

Green Shores Case Studies – Bulkhead Removal
http://stewardshipcentrebc.ca/Green_shores/case-studies/

Atlantic Canada

Sea Ice Climatic Atlas for the East Coast 1981-2010
https://www.ec.gc.ca/glaces-ice/default.asp?lang=En&n=AE4A459A-1&xml=AE4A459A-FFF4-4E38-A09E-7DF258873739&printfullpage=true
Living Shoreline Techniques and Applications for Nova Scotia
http://atlanticclra.ca/wp-content/uploads/2015/11/Wrathall-et-alUse-of-Spartina-for-natural-shoreline.pdf
The Federal Fisheries Act
https://laws-lois.justice.gc.ca/PDF/F-14.pdf

Prince Edward Island (PEI)

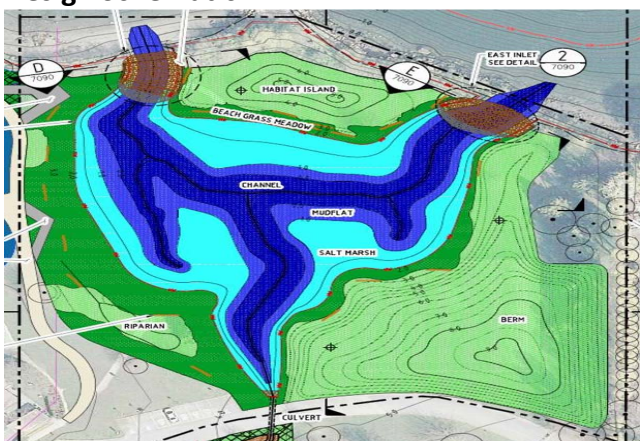
http://www.gov.pe.ca/photos/original/elj_webpkg.pdf
Nova Scotia (NS):
https://novascotia.ca/nse/watercourse-alteration/docs/NSE-Watercourse-Alteration-Program-May29.pdf
Newfoundland (NFLD):
https://www.mae.gov.nl.ca/waterres/regulations/appforms/chapter3_2.pdf

Atlantic Provinces Wetland Polices

https://online.engageyukon.ca/sites/default/files/PEI_Wetland_Policy.pdf
https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/Wetlands-TerresHumides.pdf
https://online.engageyukon.ca/sites/default/files/PEI_Wetland_Policy.pdf
https://www.mae.gov.nl.ca/waterres/regulations/policies/wetlands.html

Credit 5 Case Study: Restoration/Enhancement of Shoreline Habitats - New Brighton Park, BC

Design Schematic



Year Completed: 2017

Project Team and Affiliated Organizations:

Vancouver Fraser Port Authority
Vancouver Board of Parks and Recreation
Musqueam, Squamish, Tsleil-Waututh First Nations
Hemmera Envirochem Inc.
GL Williams & Associates Ltd.
Moffat & Nichol
Connect Landscape Architecture
Wilco Civil Inc.

Project Overview

The project site is located along the south side of Burrard Inlet immediately west of the Second Narrows Bridge in Vancouver, B.C. The New Brighton Park Shoreline Restoration Project transformed what was formerly part of an industrial harbour into a restored coastal lagoon and marsh system. The project was intended to address the high mortality of juvenile fish migrating through Burrard Inlet by creating shoreline habitat and restoring tidal influence in order to support juvenile chinook and chum salmon rearing.

Site History

Burrard Inlet and nearby coastal areas have been used by Aboriginal groups for millennia. The project site, New Brighton Park, was established circa 1930s in an area that was formerly an industrial harbour and the site of Hastings Town – the original area of the City of Vancouver circa 1865. The site formerly contained a shingle mill. Since the 1960s, extensive filling of the intertidal zone occurred in the north portion of the park. This shifted the shoreline by as much as 150 metres from its historical location, greatly reducing intertidal, backshore and marine riparian areas, vegetation, and habitat. This fill, being of unknown origin and quality, had to be tested for contamination prior to habitat restoration.

Implementation

Due to its location within a high-use urban environment, extensive consultation was required to move this project through to successful completion. This included public consultation and collaboration with the Musqueam, Squamish and Tsleil-Waututh Nations. The project area totalled approximately 2.5 hectares and resulted in the restoration and enhancement of approximately two hectares of intertidal, subtidal, instream and riparian habitat, including broad, upper intertidal salt marsh areas.

Credit 5 Case Study: Restoration/Enhancement of Shoreline Habitats - New Brighton Park, BC

How the Project Addresses Credit 5 Requirements

Materials

- Artificial fill and contaminated soils removed, site reconfigured to intertidal and subtidal lagoon, instream and riparian vegetation.

Habitat Components

- Removal of fill and bulkhead/rip rap in two areas to restore tidal flow.
- Habitat restoration plan including salt marsh, tidal inlets, and cobble creek connections.
- Completion of extensive planting program, including installation of about 25,000 salt marsh plugs, 200 native trees and 4,000 coastal shrubs.

Design and Construction Notes

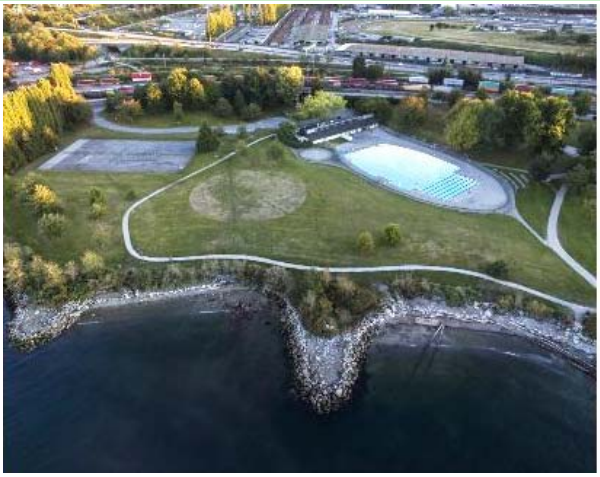
- Reconnection of riparian "corridor" from New Brighton Park marine shore to upland Hastings Park Sanctuary.
- Daylighting Renfrew Creek at upper reach of tidal marsh.
- Soil excavation to remediate facility as well as spot remediation.
- Protection of sensitive wetland with netting, and installation of strategically located fences and shrub thicket during plant establishment phase.
- Monitoring plan included multi-year monitoring to assess the functionality of the restored habitats.

Ecological Services Provided

- Creation of additional intertidal and riparian habitat with an additional 300 m of shore length.
- Increase overall ecological function of a critical area for juvenile salmon (chum and chinook) and for resting and feeding shorebirds.

Other Notes

- Project scored well for Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes (Credit 4) through removal of tidal flow barriers (fill and armour), and Outreach and Public Education (Credit 10) through extensive signage and public involvement.



Before

After

Credit 6: Enhanced Riparian Zone Protection

Intent

To encourage developments to exceed the minimum riparian zone protection (Prerequisite 4), thereby furthering conservation and restoration of riparian vegetation and ecological function and creating examples of projects that use the riparian zone as a development asset.

Context

This credit is available for projects that are able to significantly exceed the minimum riparian area protection outlined in Prerequisite 4 (conserve and/or restore a natural riparian zone for a minimum width of the larger of 10 m or any local requirement measured as a horizontal distance landward of the NB/OHWM, over a minimum of 50% of shore length or any vegetated buffer defined by local regulations). For sites with existing riparian vegetation, the intent is to retain existing natural conditions and native species as much as possible. Removal of invasive species is encouraged, and limited planting of non-native, non-invasive species can be applied. On previously developed sites, the natural riparian zone may be minimal and restoration will be required. Additional points are allocated for areas which have been actively restored.

All development activities should occur outside the designated riparian zone protection area. Public access to the designated riparian zone protection area should be limited and carefully managed; e.g., incorporate walking paths constructed of permeable material at sites where impact to riparian function is negligible. In some areas, local regulations do not permit paths through the riparian buffer (e.g., the Riparian Area Regulation in BC). Make sure designed walkways or paths are allowed in your area.

Applies to

The shore zone of the project area immediately above the NB/OHWM.

Requirements

1. Restored riparian areas must be contiguous with an unarmoured shoreline to have the greatest benefit. Points are awarded for removing armour structures under Credits 4 or 5, but not both. Paths may be permitted through the riparian zone but must be consistent with Credit 2.
2. For all sites, native plants should comprise at least 75% of the vegetation species being planted, and invasive species should never be used.

Credit 6: Enhanced Riparian Zone Protection 1-9 POINTS

Points are available for extending the protected, restored and/or enhanced riparian zone beyond the prerequisite minimum outlined in Prerequisite 4 as outlined in the table below:

Amount of Riparian Area Protected	Points
Increased Shoreline Length: 51-65% of shoreline length* of the development property shoreline is in the riparian protection zone (1 point); over 66% of shoreline is in the riparian zone (2 points)	1-2
Increased Riparian Area Width: Increasing the riparian zone width from 10 to 15m over at least 50% of shoreline (1 point); each additional 10 m width of riparian zone adds 1 point to a maximum of 3 additional points	1-4
Restoration of Riparian Habitat: If over 75% of the additional riparian area provided is restored (e.g. planted with only native vegetation)	2
Critical or Sensitive Habitats: Awarded for restoration/protection/enhancement that encompasses critical or sensitive habitat(s)	1

* The shoreline length is measured using the pre-project length of the NB/OHWM within the entire project area.

Figure 9. Photos of healthy riparian vegetation producing shade to control temperatures and provide organic material and nutrient input. Left: marine riparian example on Thetis Island, British Columbia. Right: freshwater riparian example along Lake Whatcom shoreline, Washington, US (Coastal Geologic Services, Inc.).

Credit 6: Enhanced Riparian Zone Protection 1-9 POINTS

Riparian Zone Allowances

The designated riparian zone does not need to be a continuous alongshore section (e.g., it can consist of two designated areas separated by a public access area).

While they may physically overlap on the project site, the protected riparian zone is independent of the setback for structures required under Prerequisite 1; i.e., the riparian zone may form part of the setback.

If local regulations allow, the riparian zone may incorporate stormwater infiltration design objectives to meet Credit 7; however, the stormwater infiltration structures must not compromise the ecological services provided by a riparian buffer.

Riparian restoration does not include intertidal re-vegetation, which is addressed in Credit 5.

Submittals

Submittals are similar to Prerequisite 4:

1. The appropriate Letter Template signed by a Qualified Environmental Professional.
2. A scaled site plan showing the location and typical species composition of the existing riparian zone indicating the portion to be conserved and, as needed, restored. The plan, or an accompanying report, should indicate how the conserved riparian zone will be protected during the construction phase (fencing, signage, etc.).
3. If planting is required, a vegetation or re-vegetation plan for the conserved and/or restored riparian zone prepared by a Qualified Environmental Professional, including selected plant species and landscape design. If nursery stock is used in restoration plantings, it must meet the Canadian Landscape Standard for container size and quality. Where soil conditions are expected to be dry during the summer months, establishment irrigation (minimum 2 growing seasons) should be provided. Wildlife browse protection should be provided where deer or other browsers are known to pose a threat.
4. Pre- and post-construction photographic documentation of the designated riparian zone in addition to the post-construction monitoring plan required under Prerequisite 4 for any restored (planted) areas.

Strategies and Technologies

- It may be difficult to locate enough native plants to use in riparian restoration work. If native plants are not available, there are other options that may be appropriate for the site, such as transplanting or using “volunteer” species.
- See Prerequisite 4 for additional strategies and technologies.

Resources

See Prerequisite 4.

Credit 7: Integrated Stormwater Planning and Design

Intent

To reduce impacts to the receiving aquatic environment from on-site management of stormwater runoff.

Context

The goal of federal, provincial, and local water management policy is to protect and preserve Canada's valuable water resources. These resources can become compromised by pollutants in stormwater runoff, or by increased volume and rate of stormwater runoff causing erosion, flooding and other problems. This credit promotes improved stormwater management to reduce potential impacts to receiving environments.

The landscape associated with the shore interface is typically a water shedding environment. Shoreline sites can be located along tidal rivers, close to or along the mouth of a stream discharging into a lake or estuary, or along shorelines that drain directly into the ocean. If a stream transects a shoreline site, some runoff naturally discharges into the stream. However, in general, shoreline sites tend to be non-basin drainage areas, shedding water directly to the aquatic environment along the entire shore interface rather than as a point source discharge.

Stormwater and Rainwater

Stormwater refers to the runoff associated with all rain events, not just storms. The majority of runoff is from light, steady rainfall, so stormwater management designs should be applicable for both types of precipitation events. The terms stormwater and rainwater are used interchangeably here.

On natural or undeveloped sites with healthy soils, rainwater infiltrates and becomes shallow interflow, following sub-surface pathways spreading throughout the site or traveling to deep groundwater. Some of this water is stored within the soil until evaporated or used by plants (evapotranspiration on natural sites can be as high as 40-60%). Excess water that does not infiltrate into soil travels over the surface as stormwater runoff, as shown in Figure 10 on the following page. Traditional engineering practices disrupt infiltration processes by introducing impervious surfaces like roofs and pavement, and by accelerating stormwater discharge through the installation of piped collection systems. In contrast, working with the natural site form and drainage processes to manage stormwater runoff can help maintain and enhance the ecology and physical characteristics of dynamic shoreline landscapes.

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

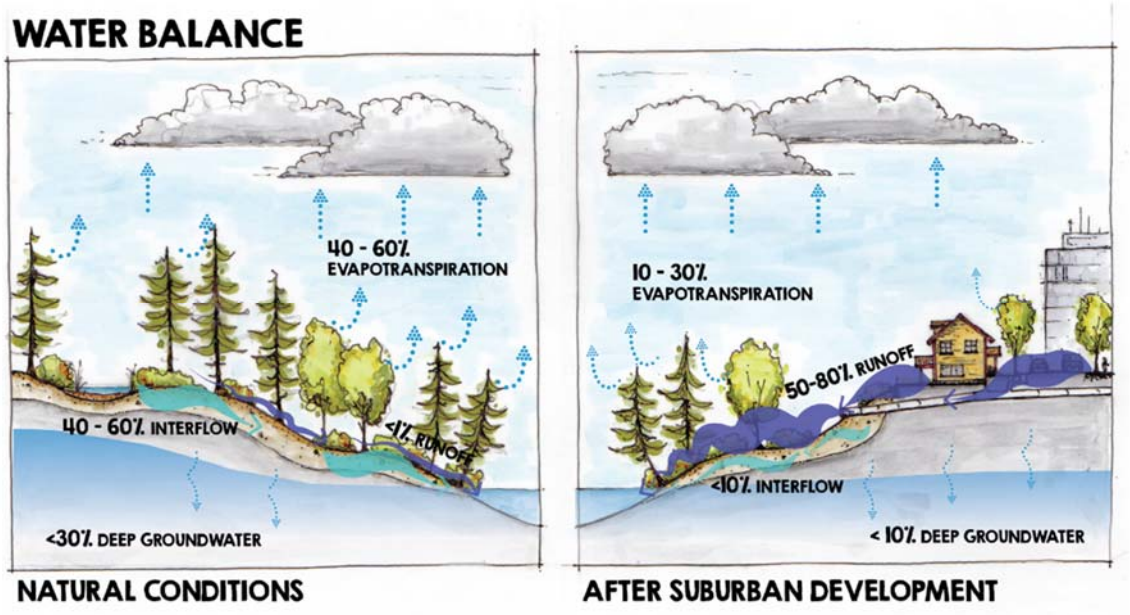


Figure 10. Water balance in the nearshore environment before and after typical suburban development (Murdoch de Greeff, Inc.).

The objectives of this credit are to allow as much rainwater as possible to soak into the ground to maintain shallow interflows and groundwater recharge, and to reduce pollution loads entering the aquatic environment via surface runoff. This requires a combination of Low Impact Development (LID) site planning to reduce impervious surface area as much as possible, and use of source control Best Management Practices (BMPs) to minimize impacts of developed areas on a site (see Strategies and Technologies below). The following strategies will help to reduce impacts from stormwater:

- Work within the constraints imposed by site features and functions (i.e., drainage patterns, land cover, slope, soil conditions, etc.) to better manage runoff, pollution, and slope stability.
- Minimize impervious surface area (ISA – see definitions below).
- Use existing site soil and vegetation as a stormwater source control and pollution filter, with care not to overwhelm or destabilize.
- Use source control BMPs to manage runoff from impervious surfaces, thereby reducing the Effective Impervious Area (EIA – see definitions below).
- Retain existing native vegetation on the shoreline (especially in the riparian zone buffer – see Prerequisite 4 and Credit 6) and manage/replace invasive species with native vegetation.
- Continue to supply moisture to riparian vegetation by minimizing changes to natural water flow pathways.

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

- Reduce the potential for shoreline and foreshore erosion by avoiding the concentration of stormwater runoff into point source discharges.
- Reduce the risk of significantly disrupting salinity regimes in contained bays and estuarine environments by avoiding concentrated stormwater discharges.
- Maintain rainwater infiltration, thereby reducing the risk of salt water intrusion to upland soils and wells.
- Avoid nutrient- or contaminant-laden runoff through avoidance or careful management of fertilizers, pesticides, petroleum products, septic fields, etc. in adjacent upland areas.
- Restore landscape functions of degraded landscapes (natural infiltration process, groundwater recharge, re-establish drainage patterns, etc.).

ISA and EIA

Impervious Surface Area (ISA) is the area of a given lot or property that is covered by man-made surfaces that do not allow stormwater to infiltrate through them; instead, stormwater runs off the impervious surfaces quickly, picking up pollutants on its way. ISA includes rooftops, roads, sidewalks, driveways, and parking lots that are covered by impenetrable materials such as shingles, asphalt, concrete, plastic, brick, and stone. ISA is often referred to as the "built footprint" and as this credit emphasizes, a smaller built footprint is good for the environment and the pocketbook.

The adverse effects of ISA can be mitigated using landscape-based source control BMPs that slow down and clean stormwater prior to stormwater reaching the receiving environment. *Effective Impervious Area (EIA)* is the total ISA minus those surfaces that drain to and are effectively managed by source control BMPs. Source control BMPs manage stormwater runoff at the source and include landscape-based water management installations such as rain gardens, rain planters, bioswales, green roofs and permeable paving.

Applies to

The development property and adjacent foreshore as well as consideration of upland inputs such as streams, seeps, groundwater flow and human-made stormwater structures.

Requirements

Develop and implement a comprehensive stormwater management plan for the project that demonstrates a maximum of 20% EIA (see table below for point breakdown) by way of the following:

- Protection of natural features, including native vegetation
- Reduction of ISA through application of LID techniques
- Management of as much stormwater as possible through infiltration, evapotranspiration, and water storage/reuse in site green spaces without causing damaging impacts to green spaces

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

- Application of landscape-based source control BMPs (see section below for BMP design criteria)

Developed/Non-Park Sites	
Effective Impervious Area (percent EIA)*	**Points**
<20%	3
<10%	4
0-1%	5
Undeveloped/Park Sites	
Effective Impervious Area (Percent EIA)**	**Points**
<5%	2
<2%	3
0-1%	4

* The goal of this credit is to reduce Effective Impervious Area (EIA) as much as possible, ideally treating 90% or more of stormwater runoff in source control BMPs.
**Points are assigned for parks using tighter criteria given that they generally have fewer impervious surfaces and larger green spaces in which to manage runoff, compared to other land uses.

Submittals

1. Letter Template signed by a qualified professional.
2. A stormwater management plan that includes:
    - An existing conditions site plan that indicates form and function of the landscape and includes, for all sites:
        i. Site contours and spot elevations,
        ii. Runoff flow paths and water bodies (wetlands, ponds, lakes, etc.),
        iii. Existing vegetation,
        iv. General soil/geologic conditions,
        v. Impermeable Surface Area (ISA) as a percentage of total site area.

      For highly modified sites, items i through v and:

        vi. Historical information as it relates to hydrological conditions on the site (e.g., wetlands, depressions, and shore environments that have been filled),
        vii. Pre-development flow paths based on site topography.

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

For parks or conservation areas, items i through v and:

viii. An outline of high traffic areas (e.g., pedestrian, boat launch, off-leash dog areas, picnic areas) that would likely contribute higher amounts of pollutants to the receiving environment.

- A site design plan indicating the project's development footprint and the location of planned source control BMPs. This should include the proposed ISA and EIA calculations.
    i. For parks and conservation areas, this should include a strategy that specifically outlines areas where pedestrian traffic is allowed and areas that will be 'naturalized' or restrict public access, along with planned source control BMPs that address/mitigate the high traffic areas identified in the site plan.
- The calculation and/or model and associated methods and results used to calculate rainfall events and water volumes pre- and post- development. This submittal requires a stormwater professional's input and verification.
- The source control BMPs to be employed, including designs and specifications.
- IDF curves and/or climate data used in calculations (if applicable).
- A stormwater maintenance plan that details how stormwater facilities will be managed over time. This maintenance plan should include:
    i. Vegetation care without the use of synthetic fertilizers, pesticides, herbicides, or fungicides, which can harm the aquatic environment.
    ii. Methods for adaptive management of stormwater, such as those that use water quality and/or surface water flow rate monitoring to track the success or failure of the installed stormwater treatment facilities.
    iii. A financial plan for the ongoing maintenance and remediation, if necessary, of the stormwater treatment features.
    iv. Plans should outline maintenance for a minimum of three years.

Strategies and Technologies

Site designs should fit the hydrologic environment and work with the natural landscape. To achieve this, it is important to understand how the site functions in its present and/or pre-development condition, and how it may fit into a larger drainage pattern for the area. In this way, the design team can more easily integrate building and site infrastructure design schemes while maintaining or enhancing site functions. This approach often identifies opportunities such as old drainage features, historical land and aquatic features, and intrinsic site values that might otherwise be overlooked.

Integrated and sustainable designs should have low environmental impacts and pose no risks to humans. Examples include:

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

- Identify and work with sub-drainage patterns present on the site; runoff from one area should not be directed to other sub-drainage areas.
- Utilize Low Impact Development (LID) practices to reduce impervious surfaces and infrastructure development. Examples include:
    - Clustering buildings to protect natural vegetated areas (see Credit 1),
    - Creating more efficient road circulation patterns to reduce road length, width and impermeable surface area,
    - Enhancing pedestrian and bicycle circulation to reduce automobile trips,
    - Avoiding development in areas of natural landscape and agricultural soils,
    - Reducing landscape disturbance and material use by building on already present infrastructure,
    - Avoiding erosion and subsequent loss of nutrients and organic matter by building on suitable soils,
    - Preserving native vegetation, especially trees.
- Direct runoff from impervious surfaces (roofs, driveways, walks, etc.) into landscape areas designed to manage runoff (source control BMPs). For example, identify areas of permeable soils and develop as infiltration areas. Also, consider filtration beds, vegetated bio-swales, and rain gardens to help manage runoff. In highly consolidated, high clay/silt soils, infiltration through a rain garden (see schematic below) or other suitable treatment to an under drain that then discharges to a storm drain may offer appropriate treatment.

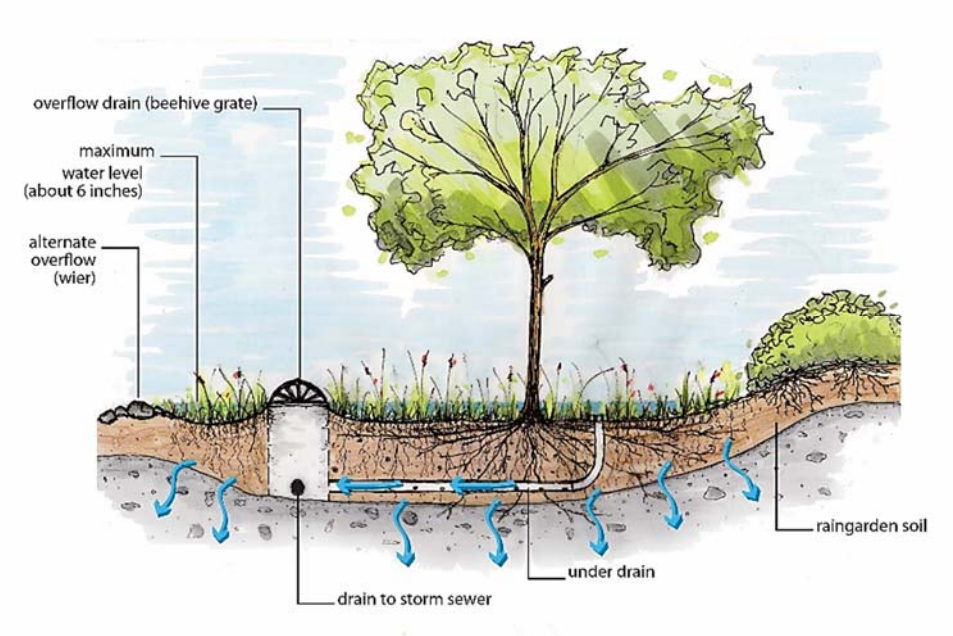


Figure 11. Rain garden cross section (Murdoch de Greeff, Inc.).

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

- Replace point (end of pipe) discharges to the foreshore with diffuse discharges alongshore to simulate natural seepages and reduce erosion potential.
- Re-establish shallow interflow drainage using flow spreaders and other water dispersal BMPs.
- Use permeable materials such as permeable pavers, structurally reinforced grass or gravel surfaces and other permeable hardscape surfaces for parking lots, driveways, plazas, patios and walkways.
- Create 'green roofs', which use soil and plants to absorb and evaporate water and slow runoff.
- Separate water from roofs, which is generally clean, from ground-level runoff, which tends to have higher levels of contaminants. Treat and discharge each separately. Where possible, re-use roof water (e.g., use for toilet flushing or irrigation).
- Favour landscaping methods and management practices that don't require fertilizer or pesticide treatments i.e., wild meadows, native plantings, etc., and avoid or minimize any pollution-generating surfaces, such as landscaping that will require treatments of fertilizers or pesticides, and other sources of pollution such as vehicles leaking contaminants or septic system failures.
- Ensure adequate, clean/treated drainage to sensitive nearshore features that require freshwater input such as wetlands and intertidal marshes.

Figure 12. Example of a bioswale used to filter runoff, New Brighton Park, Vancouver BC (Coastal Geologic Services, 2018).

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

Source Control Best Management Practices (BMPs) – Design Rationale and Guidelines
Stormwater source control BMPs are landscape-based methods that slow and cool stormwater and that reduce or prevent pollutants from entering natural receiving environments. The stormwater management plan requires the application of source control BMPs.

Source control BMPs are typically designed to manage (i.e., store and infiltrate at the source) a *water quality rainfall event*. A water quality rainfall event in coastal areas of lower Salish Sea (i.e., the east coast of Vancouver Island and the Sunshine Coast) is about equal to a 6-month frequency/24-hour duration rainfall event (local intensity-duration-frequency, or IDF, curves and/or verifiable site-specific climate data should be used to calculate the 6-month/24-hour event). In the lower Salish Sea region, designing a source control BMP to manage a 6-month event results in about 90% of the average annual rainfall being infiltrated through the source control BMP. Larger storm events are designed to flow overtop of source control BMPs and into a safe stormwater discharge location, but these events are generally carrying cleaner 'second flush' water, so infiltration is less critical. Regions in Canada with more or less annual rainfall should design stormwater systems to capture and treat 90% of the average annual rainfall amount using source control BMPs.

Source control BMPs should be designed to return rainwater to the ground as shallow interflow or deeper groundwater, or infiltrate water through at least 450mm of permeable material (e.g., a sand-based growing medium) before entering a drainpipe. The slower the infiltration rate of the growing medium used in the BMP, the larger the area of the BMP required to manage a given impervious contributing area. Where BMPs are design to infiltrate water into the ground below the BMP, infiltration rates of native ground below the BMP should be tested to ensure they are capable of accommodating inflows.

Any runoff in excess of the water quality rainfall event that is not infiltrated through the BMP growing medium and absorbed by the landscape must be discharged in a manner that:

- Does not erode or destabilize the shoreline or foreshore.
- Does not cause significant sediment transport over and above natural levels in the surrounding area.
- For estuaries and contained bays with limited volume mixing, does not significantly disrupt natural salinity regimes.
- Does not result in flooding or erosion of adjacent areas.

Credit 7: Integrated Stormwater Planning and Design 2-5 POINTS

Resources

General

Water Balance Model Canada.
http://www.waterbalance.ca/
Green Roofs (focuses on Great Lakes shores, located in Duluth, MN, USA on Lake Superior)
http://www.lakesuperiorstreams.org/stormwater/toolkit/greenroofs.html
Permeable Pavements: Context and Applications webinar
http://www.wastormwatercenter.org/lid-permeable-pavements/
Marsh, W., 2005. Landscape Planning and Environmental Applications, 5th Ed. John Wiley & Sons, Inc.
Low Impact Development - Technical Guidance Manual for Puget Sound (2012)
http://www.psp.wa.gov/downloads/LID/20121221_LIDmanual_FINAL_secure.pdf
Rain Gardens: Improve Stormwater Management in Your Yard
https://www.rainchaincanada.com/articles/61-rain-gardens-improve-stormwater-management-in-your-yard
Houle, J., Roseen, R., Ballestero, T., Puls, T., & Sherrard, J, 2013. "Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management." Journal of Environmental Engineering. 139:7 pp. 932-938.
LeFevre, N., Davidson, J., & Oberts, G. (2009). "Bioretention of Simulated Snowmelt: Cold Climate Performance and Design Criteria." Cold Regions Engineering 2009. pp. 145-154
Municipal Natural Assets Initiative – Pilot Communities Case Studies
https://mnai.ca/pilot-communities/

British Columbia

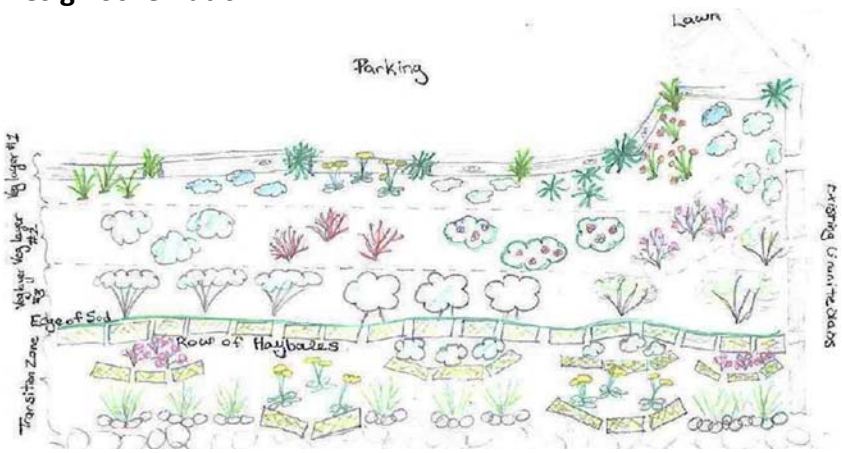
BC Ministry of Water, Land and Air Protection. 2002. A Guidebook for British Columbia Stormwater Planning
http://www.toolkit.bc.ca/resource/stormwater-planning-guidebook-british-columbia
BC Ministry of Environment Water Quality Municipal Best Management Practices
http://www.env.gov.bc.ca/wat/wq/nps/BMP_Compendium/Municipal/Municipal_Home.htm
Stormwater Source Control Design Guidelines 2005. Greater Vancouver Regional District.
http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/StormwaterSourceControlDesignGuidelines2012StormwaterSourceControlDesignGuidelines2012.pdf
Rainwater Management Standards: DIY for your home (City of Victoria Stormwater Utility, 2015)
https://www.victoria.ca/assets/Departments/Engineering~Public~Works/Images/Stormwater/Rainwater%20Management%20Standards%20-%20DIY%20For%20Your%20Home%20May%202015%20Edition.pdf
BC Adapts Video Series
https://www2.gov.bc.ca/gov/content/environment/climate-change/adaptation/bc-adapts

Atlantic Canada

Toronto and Region Conservation Authority (TRCA) Publications:
2012. "Stormwater Management Criteria."
2012. "Low Impact Development Stormwater Management Planning and Design Guide."
2013. "Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices."
2008. "Performance Evaluation of Permeable Pavement and a Bioretention Swale."
2015. "Five Year Performance Evaluation of Permeable Pavements."
Low Impact Development Centre (located in Maryland, USA)
http://www.lowimpactdevelopment.org/

Credit 7 Case Study: Integrated Stormwater Planning and Design – Shelburne Waterfront, NS

Design Schematic



Year Completed:

2019

Project Team and Affiliated Organizations:

Coastal Action

CBWES Inc.

Town of Shelburne

Project Overview

The goal of this project was to reduce runoff and erosion along an approximately 15-metre-long section of shoreline at the downtown Shelburne waterfront. To achieve this goal, the implementation of a vegetated buffer between the parking lot and existing armour stone was proposed at the site. Native perennials and shrubs were installed and now help to facilitate the infiltration of runoff from adjacent roads, protect the soil surface integrity, and increase the stability of the soil. Structural elements such as logs, brush, and haybales were added to protect the new plantings and reduce peak flows across the site.

Site History

The Town's waterfront currently features old rock armouring, mowed turf, a gravel parking lot, and urban development – primarily roads and homes – located upland of these features. Peak flows from adjacent developments and storm surge from the coastal boundary have been the main drivers of erosion and scour at the waterfront. During the 2018 storm surge, the rock armour revetment was breached and Shelburne's waterfront flooded (including this site), causing significant damage to road infrastructure as well as residential and commercial property.

Implementation

The buffer was installed on August 17, 2019 by Coastal Action, CBWES and 25 to 50 community volunteers from the Town of Shelburne. The project area enhanced 15 m (approximately 50 ft) of the shoreline and approximately 93 m^2 of the total surface area using vegetation, soil, and soft structural elements which reduced the erosion and scour potential of the site.

Credit 7 Case Study: Integrated Stormwater Planning and Design – Shelburne Waterfront, NS

How the Project Addresses Credit 7 Requirements

Materials

- Logs were secured around the edge of the gravel parking lot to act as spatial boundaries, prevent cars from driving on newly vegetated area, and slow the flow of runoff from the parking lot. The logs are 20-30 cm in diameter and a minimum of 1.8 to 2.4 m long.
- A solid row of haybales was secured along the edge of the sod to add scour protection. Haybales also reduce peak flows, deflect wind and wave energy, and add nutrients and seed stock to the site's ecosystem. Haybales were secured with wooden stakes and twine.

Stormwater Components

- **Vegetation layer 1:** Approximately 1.2 m wide. The lawn closest to the parking lot was converted to herbaceous perennials and small shrubs, including flowering perennials and fruit-bearing shrubs for improved aesthetics.
- **Vegetation layer 2:** Approximately 1.2 m wide. This area was planted with medium-sized shrubs to increase the viability and structural diversity of the natural habitat and treat runoff.
- **Vegetation layer 3:** Consists of large shrubs to provide Layers 1 and 2 protection from wind and waves. Deeper root systems enhance structural stability at the vulnerable sod edge.
- **Transition zone:** Approximately 2.4 to 3.7 m wide. The goal in this area is to increase plant diversity using hardy, salt tolerant species. Grasses and perennials were planted near the water and a shrub layer was planted close to the haybale row. Evergreen brush was secured around the base of the plantings to protect the soil and root zones while plants establish themselves.
- Vegetated buffers will infiltrate an average of 27.3 m^3 of stormwater runoff annually (ranging from 13.7 to 68.2 m^3).

Design and Construction Notes

- Detailed design drawings included plans, design of vegetated buffer, and planting schedules at the transition zone.
- A maintenance and multi-year monitoring plan were included with recommendations for periodic check-ins.

Ecological Services Provided

- Creation of additional habitat and forage (especially for small birds).
- Infiltration of stormwater runoff (sediment and road pollutants).
- Stabilization of soil to strengthen zone integrity.

Other Notes

- Relevant credits include Outreach and Public Education (Credit 10), because the project included extensive educational signage and public engagement events throughout the installation.

Before

After

Credit 8: Climate Change Adaption Plan

Intent

To encourage planning and design that can support natural resilience of the shoreline to climate change impacts and may reduce risk to waterfront development from sea level rise and other related climate impacts.

Context

Development along the shore often does not plan for or accommodate the dynamic nature of the shoreline, resulting in artificially static shoreline positions which can lead to flood and erosion hazards for the upland developments. This credit recognizes that while development density is increasing along the shore, global climate change presents current and future threats to development and human safety through the following:

- Projected sea level rise (anticipated to accelerate globally) resulting in increased coastal inundation and increased coastal erosion.
- Higher wave heights resulting from increased storm intensity and frequency which accelerates shoreline erosion (including at coastal bluffs) and storm surge flooding.
- Changes in the extent, thickness, and duration of seasonal sea and lake ice resulting in increased wave energy reaching the shoreline.
- Increased precipitation as rain and runoff compounded by drainage problems due to higher sea levels and/or water tables.
- Fluctuating water levels in reservoirs due to increased drought or rainfall frequency in some areas.

The natural response of a shoreline to sea level rise varies based on the type of coastal landform found on the property (see figure to right). For example, beaches and other coastal landforms will naturally adapt to the rise in sea level by building to higher elevations and/or gradually shifting landward. Habitat zones will shift landward accordingly. Bluff shores will shift landward. The eroded sediment typically helps maintain the natural beach width., provided there is enough sediment supply to keep up with sea level rise.

For armoured shores, this landward adjustment of the beach profile is unable to occur and the rise in

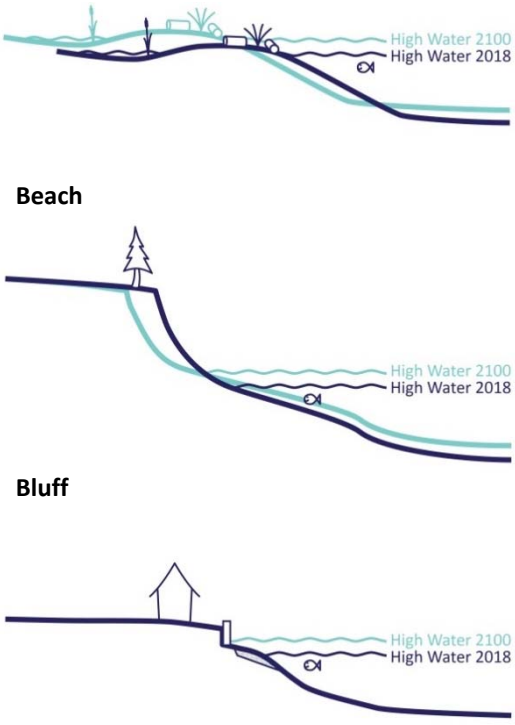


Figure 13. Shoreline response to sea level rise (Coastal Geologic Services Inc., 2018).

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

sea level meets the static structure, resulting in submerged intertidal habitats. This habitat loss is commonly referred to as "coastal squeeze." The shore type or combination of shore types found on a given property will guide the development of the adaptation plan.

Climate Change and Program Limitations

Although Green Shores approaches can be used to address SLR, the GSSD guide and rating system does not attempt to address the more complex coastal engineering needed to fully deal with SLR effects. The program does not provide the expertise to verify that any given project rated under the GSSD system will protect adequately against SLR. Both the design and verification for projected SLR requires a higher level of coastal expertise than the Green Shores certification assures. Green Shores certification does not assure that climate change adaptation engineering designs will be effective at attaining the specific design objectives. Various levels of government are developing guidance and regulations that address projected SLR. Applicants must refer to the best available science and are encouraged to meet or exceed such guidance. A list of resources is provided at the end of this section to aid in understanding the credit requirements and preparing the submittal materials.

Applies to

All permanent structures (new and existing), shore protection works and other development amenities situated within the shore area of the development property.

Requirements

1. Documentation of projected change in the location of the 1 in 100-year extreme WL at the site due to climate change to the year 2100 or the life of the project, whichever is greatest.

   AND

2. Documented measures that accomplish one or more of the following approaches to adapting to the above-projected change in the NB/OHWM as a result of climate change – see Strategies and Technologies for example measures for each approach:
   - Avoid
   - Retreat
   - Accommodate
   - Protect

Lake Shores

Climate change will also affect lake and reservoir shores. Impacts include flooding, less ice buildup in colder months, increased wave action in larger lakes, and associated erosion and damage of docks and other overwater structures. Hence, this credit applies to lake shores.

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

	Climate Change Adaption Plan Requirements and Strategies	Points
	Documented change of NB/OHWM, AND	1
Primary Approach*	Avoid	4
	Retreat	3
	Accommodate	2
	Protect	1

*** Note:** These strategies are not mutually exclusive and can be combined across multiple areas of the project site depending on what is most appropriate for each reach of shore. For example, if the site is very large and encompasses several different shore types (e.g., a bluff and a beach), an applicant may plan to apply the Retreat approach to the bluff shore and the Accommodate approach to the beach shore. Please keep in mind that the Avoid and Retreat approaches are preferred over the Protect and Accommodate approaches. **If multiple actions are taken on the property, the applicant will receive points for the highest-scoring strategy option.**

Sea Level Rise Projections: Using the Best Available Science
A key element of this credit is to project changes to the location of the natural boundary over the life of the project and the selected planning horizons (e.g., year 2100 or life of the project). References to the best available national, provincial or local sea level rise projections and the anticipated consequences of climate change are required. National or provincial projections should be adjusted to account for local vertical land movement (isostatic adjustment associated with post-glacial rebound or local subsidence) to provide an estimate of relative sea level rise (RSLR). Many climate scientists now consider that the higher estimates of global sea level rise should be used for climate change adaption planning.

Submittals

1. The applicable Letter Template signed by a Qualified Coastal Professional.
2. A report describing the basis of the projection of the NB/OHWM through the end of the project life or 2100, whichever is greater. This should include:
    - The projected relative sea level rise used for the site, planning horizons, with additional evaluation of wave run-up and storm surges/high water events where available. Local sea level rise projections should be referenced when possible.
    - Consideration of background geomorphic trends should also be considered, as different shore types will respond differently to the rise in sea level and at different rates. For example, coastal erosion is anticipated to accelerate along coastal bluffs in association with sea level rise.

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

- If relevant, the report should also address the expected effects of increased precipitation as rain and associated surface runoff or groundwater flow and the expected effects on sediment supply in the shore reach in which the site is located.
- For lakes and reservoirs, if data are available, the report should include projected changes to water levels, anticipated high water events and changes to precipitation patterns that may lead to flooding and erosion.

3. A site plan indicating the projected NB/OHWM location, related setbacks (relevant to the projected NB/OHWM), structure locations and designs to meet one or more of the four approaches described above. **Please specify which approach(es) will be used.**

Strategies and Technologies

Strategies for dealing with expected climate change are continually being developed around the world, but can be generally characterized as:

1. **Avoid** – Avoiding altogether the need for protective measures over the life of the project. For example, site design should employ adequate setbacks based on Prerequisite 1, but from the *projected* NB/OHWM rather than the current NB/OHWM. Another example is a site design with no development in portions of the site that would be inundated by projected sea level rise and/or storm flooding. This option receives 4 points due to its little to no impact on habitats and sediment processes on the site and its consideration of negative impacts on adjacent sites.
2. **Retreat** – Physically moving existing structures and/or allowing for the future movement of structures. This includes measures such as:
    - Moving existing permanent structures above the projected NB/OHWM, out of the path of projected inundation.
    - Removing existing (hardened) protective structures and not re-establishing protective structures in the same location

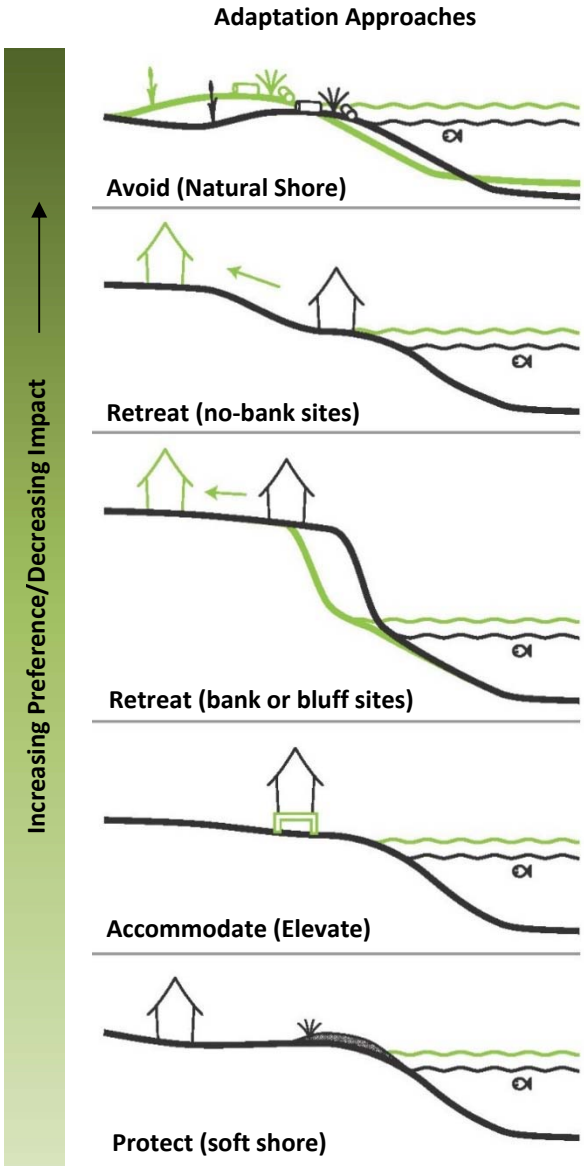


Figure 14. Adaptation approaches at barrier beaches and shoreline banks (Coastal Geologic Services, 2015).

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

or establishing them further landward and instead allowing for future inundation of the shoreline area (e.g., creation of salt marsh, dyke realignment).

- Allowing sufficient room for future retreat of the riparian zone (i.e., landward translation).
- Recognizing that property threatened by climate change may be abandoned when conditions become intolerable, and planning now for the removal of such structures such that they do not negatively impact shoreline processes in the future. In some cases, resettlement, recombination of affected property boundaries and the adjustment of sub-boundaries may be a more cost-effective long-term option than Protect or Accommodate.
- 'Rolling covenants/easements' are tools that allow for development in shoreline areas but without protective structures, and with the acknowledgement that the NB/OHWM will move inland over time, eventually forcing retreat or abandonment. More information about the specific planning options available in your area can be obtained from your local land use planning department or similar government office.

This option receives 3 points due to its minimal impact on shoreline habitats and sediment processes and the amount of effort required to physically move structures, but avoiding altogether the need to enact such removal or replacement measures is preferred where feasible.

Figure 15. Armour removal and retreat project at Waypoint Park in Bellingham, Washington, (US), designed to accommodate significant sea level rise. Left: before removal. Right: current active beach (Coastal Geologic Services Inc.).

3. **Accommodate** – Continuing occupation of land while making adjustments to structures and infrastructure to accommodate the effects of climate change and SLR. Measures include:
    - Raising structures above projected flood levels (i.e., higher than existing Flood Construction Level requirements) in ways that meet Green Shores principles (e.g., not using creosote-treated piles or fill, see Prerequisite 1).
    - Redesigning existing structures (e.g., 'floodproofing').

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

- Designing restoration or rehabilitation works for rising sea levels (e.g., designing for future elevation of constructed intertidal marshes).
- Adjusting use to allow for periodic flooding (e.g., occasional closure of public walkways).
- Entering into appropriate covenants that acknowledge the potential hazard and limit liability of public agencies.

Accommodation may also include measures to address other on-site issues. For example, low-lying coastal communities will face increasing difficulties draining treated wastewater and stormwater via traditional gravity-based systems, as these systems may 'back up' with rising seawater at their outlets. This will be exacerbated if more extreme precipitation events also occur as part of climate change. Accommodation may include modifications to these systems. Accommodation receives 2 points due to the increased chance of impact to shore environments. For example, existing structures may become overwater structures if raised, or have a groyne effect on alongshore sediment transport if left in place when the shoreline translates landward.

4. **Protect** – In the context of Green Shores, this involves soft protection measures such as storm berms or dunes, beach replenishment, and wetland restoration or creation. Hard armour is not an option under this credit for the purposes of Green Shores rating, though in many cases a soft shore protection design may include hybrid structures that use large logs or boulders. Use of Green Shores applicable measures are generally covered by other credits (such as Prerequisites 1 and 3, Credits 4 and 7). The difference for this credit is that the use of such measures must allow for projected climate change effects in their design. This option receives 1 point because it has the most potential impact on the shoreline environment.

Credit 8: Climate Change Adaptation Plan 2-5 POINTS

Resources

General

Canada's Changing Climate Report, 2019 – An interactive web story of the CCCR2019 report detailing how climate change has affected Canada and what to expect in the future, based on the best available science.
https://changingclimate.ca/CCCR2019/
Government of Canada Library of Climate Resources (includes guidance documents for different provinces and community services)
https://climate-change.canada.ca/climate-library
Canada's Marine Coasts in a Changing Climate
https://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2016/18388

Twenty-first century mean sea level rise scenarios for Canada (Han et al. 2016)
http://publications.gc.ca/collections/collection_2016/mpo-dfo/Fs97-18-313-eng.pdf
Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT)
http://www.bio.gc.ca/science/data-donnees/can-ewlat/index3-en.php

US Army Corps of Engineers – Incorporating Sea Level Change Considerations into Civil Works Programs – contains guidance on calculating sea level rise over a project life (to 2100)
https://www.cakex.org/documents/incorporating-sea-level-change-considerations-civil-works-programs
Intergovernmental Panel on Climate Change
http://www.ipcc.ch/
Adapting to Coastal Climate Change – USAID report
http://www.crc.uri.edu/download/CoastalAdaptationGuide.pdf
Sea Level Rise – The ECoAS Project
http://sealevelrise.ca
Sea level rise considerations for nearshore restoration projects in Puget Sound
http://www.wacoastalnetwork.com/files/theme/wcrp/considerations/Restoration-Raymondetal.2018-compressed.pdf

British Columbia

Projected Sea Level Changes for British Columbia in the 21st Century
http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=5531

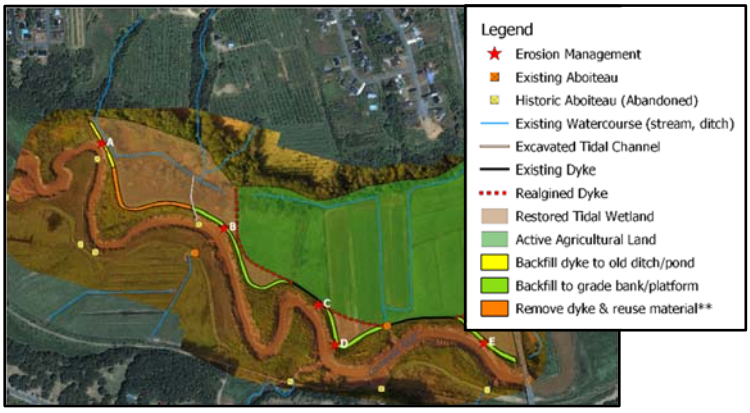
Greening Shorelines to Enhance Resilience: An Evaluation of Approaches for Adaptation to Sea Level Rise
https://www.stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/Greening_Shorelines_to_Enhance_Resilience.pdf
Flood Hazard Area Land Use Management Guidelines (amendment 2018)
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/final_amendment_to_s_35_and_36_fhalumg_17-10-01.pdf

Atlantic Canada

Scenarios and Guidance for Adaptation to Climate Change and Sea-Level Rise – Nova Scotia and Prince Edward Island Municipalities (2011)
https://www.novascotia.ca/nse/climate-change/docs/ScenariosGuidance_WilliamsDaigle.pdf
Climate data for Newfoundland and Labrador
https://www.exec.gov.nl.ca/exec/occ/climate-data/index.html
Atlantic Climate Change Adaptation Solutions Association (ACASA)
http://atlanticadaptation.ca/
TransCoastal Adaptations, Centre for Nature-Based Solutions
https://www.transcoastaladaptations.com/
Coastline Change in Prince Edward Island, 1968-2010 and 2000-2010
https://atlanticadaptation.ca/en/islandora/object/acasa%3A214

Credit 8 Case Study: Climate Change Adaptation Plan – Towns of Kentville, New Minas and Port Williams, NS

Design Schematic



Year Completed:

2018

Project Team and Affiliated Organizations:

Nova Scotia Department of Agriculture

CBWES Inc.

Saint Mary's University

TransCoastal Adaptations: Centre for Nature-Based Solutions

Department of Fisheries and Oceans Canada

Project Overview

The Belcher St. Marsh is located on the north side of the Cornwallis River, east of Kentville, NS. The site was a mix of active and fallow agriculture protected by dykes on both banks of the main river channel, eliminating the natural floodplain. The intention of the restoration project was to reduce the amount of dyke infrastructure, restore around 9.7 hectares (ha) of wetland habitat (6.5 ha former agricultural land, and 3.2 ha of foreshore marsh), contribute to efforts to increase the resiliency of the Cornwallis River system, and to reduce the flood risk to the towns of Kentville, New Minas, and Port Williams. Such an approach is referred to as 'Managed Realignment' of dykes. Provided it is supported by land use planning and hydraulic studies, managed realignment represents a viable option to accommodate climate change flooding impacts, strengthen coastal defenses, address foreshore erosion, restore significant coastal habitats and protect biodiversity.

Site History

A part of the Bay of Fundy's Minas Basin, the Cornwallis River is a significant tidal river with the head of the tide extending a short distance upstream from the project site. The dykes along the Cornwallis River are positioned close to the bank of the main river channel, resulting in a long sinuous dyke system which is costly and labor-intensive to maintain in the face of climate change, and which is highly susceptible to erosion, as was the case at multiple locations at the project site.


Aerial view of restored areas

Implementation

Construction included building an access road, 565 m of new dyke (straightened and new sections), 240 m of existing dyke topped, approximately 1,040 m of old dyke decommissioned, excavation of a historical tidal channel, and the stabilization of several sections of foreshore using nature-based techniques. The first phase of the restoration project was implemented in 2017 consisting of a feasibility and design study, community consultation, and the development and implementation of a long-term monitoring program. Dyke realignment, wetland restoration and shoreline stabilization activities were carried out in June 2018. Monitoring will continue for 3 years.

Credit 8 Case Study: Climate Change Adaptation Plan – Towns of Kentville, New Minas and Port Williams, NS

How the Project Addresses Credit 8 Requirements

Materials

- A combination of existing soils, boulders and native trees and wetland plants were used to create a hybridized living shoreline in areas that required erosion control.
- The new set back dyke was constructed from soils from two adjacent upland sources.

Habitat Components

- Restoring habitat including salt marsh, living shoreline encompassing 9.7 ha tidal wetland habitat (6.5 ha former agricultural land, and 3.2 ha foreshore marsh), as delineated by vegetation (upland edge to foreshore edge) and hydrology.
- The wetland restoration approach relied on natural processes to revegetate the wetland, however, limited planting of native wetland plants via plugs, seeds, and transplants were used as part of the shoreline stabilization activities.

Climate Change Adaptation

- Accommodation of climate change-induced sea level rise by restoring tidal wetland habitat, restoring a part of the natural floodplain and reducing the length of dyke to maintain.
- Overall dyke length was reduced from ~1.34 km to 800 m, was set back from the edge of the river, and crest elevation raised to protect 22.6 ha of agricultural land (80% active, 20% fallow) based on 1:100 year extreme water level.
- New dyke location was determined based on hydrological and erosion analysis and consultation with the land owners and local authorities in order to balance restorable wetland area and protection of high value core agricultural lands.
- A central tidal channel was created to allow tidal flow over a broader range of tides and freshwater discharge; the 1,040 m of old dyke was leveled into the site to the foreshore elevation along all sections of the realigned dyke.
- Hybrid living shoreline techniques involving the use large woody debris, inverted root wads, rock and native plants to stabilize two sections of the foreshore marsh and riverbank.

Ecological Services Provided

- Net gain restoration of provincially significant wetland (salt marsh); reestablishment of natural processes; increased primary productive, biodiversity, and carbon storage; re-establishment of resident and migratory fish and bird habitat; flood plain restoration and reconnection of the project site to the boarder Cornwallis River and Minas Basin estuarine system.
- Constructed living shoreline provides increased ecological services as compared to previous traditional dyke or shoreline hardening.

Left: Before dyke realignment

Right: Living shoreline and adaptive management

Credit 9: Exceptional Performance and Innovation

Intent
To recognize designs that exceed the requirements set by the Green Shores rating system, or that incorporate innovative approaches to meeting the credit requirements. To encourage sharing innovations in shoreline development design.

Context
Green site planning, restoration, and alternative shore protective design approaches are continually evolving, and suitable designs for specific sites and site conditions are not readily available to professionals or the public. The innovation credit is intended to encourage the project team to develop novel designs to meet specific conditions, and to build expertise and experience within the professional community with Green Shores approaches and designs.

This credit includes exceeding Green Shores performance standards in specific credit categories as well as innovation in categories not specifically addressed by the rating system, but which meet the guiding principles of Green Shores.

Applies to
The development property and adjacent foreshore.

Requirements

- For credits with a quantifiable performance measure – designs and techniques that: (a) exceed the specified performance measure by 50% or (b) demonstrate a new or improved method of meeting the specified performance measure.

  OR

- For credits without a specific performance measure or a performance measure that cannot be exceeded (e.g., “conserve 100% of….”) demonstrate a new or exceptional method of meeting the credit.

  OR

- Demonstration that the project design or planning process has addressed a specific issue or situation not covered by any Green Shores credit but which addresses Green Shores principles.

  AND

- The applicant must be willing to make the innovation credit submittal publicly available on the Green Shores website or other public forum.

Credit 9: Exceptional Performance and Innovation 1-2 POINTS

One point will be awarded for each innovation initiative – to a maximum of 2 points total regardless of the number of innovative measures being considered.

Innovation - Action	Points
One innovation initiative in project design and construction	1
Two innovation initiatives in project design and construction	2

Submittals

1. Letter Template signed by the proponent's responsible individual.
2. Identify, in writing, the rationale for the proposed innovation credit and demonstrate how the approach or design meets the guiding principles of the Green Shores project as well as the requirements stated above. Provide an illustration of the design concept, highlight the specific innovative or exceptional portions of the site plans, and photographic documentation of pre- and post-construction conditions if applicable. For innovative building siting or methods for conserving or remediating shoreline processes, provide a design basis report as outlined in this document under the respective credit categories.
3. Authorization by the proponent's responsible owner/individual to make the innovation credit information available to the general public.

Strategies and Technologies

Examples of approaches and designs qualifying for innovation credits include:

- New beach or coastal wetland protection designs that meet Green Shores principles.
- New and different ways of avoiding or mitigating development impacts on sensitive habitats and species.
- A particularly comprehensive design process that involves a wide range of expertise in a variety of methods and venues.
- Imaginative public consultation processes that go beyond basic stakeholder consultation and involves the community extensively and effectively.
- Exceeding by 50% maximum thresholds specified in Credit 5: Restoration/Enhancement of Coastal Habitats, Credit 6: Enhanced Riparian Zone Protection or Credit 7 Integrated Stormwater Design.

Credit 10: Outreach and Public Education

Intent

To support and encourage the increased adoption of Green Shores design principles by shoreline property owners, developers, contractors, the professional community, and local governments.

Context

Impacts to shoreline ecosystems from waterfront development are not always recognized by planners, developers and waterfront property owners. As a result, shore protection works are frequently designed and built without full regard for their impact on the shore ecosystem. Even when these impacts are recognized, appropriate designs to minimize impacts are not readily available. Making Green Shores design projects and information accessible to interested groups for educational and stewardship activities increases awareness of shoreline development issues and provides greater accessibility to resources and design expertise to improve how these issues are addressed.

Applies to

The development property and adjacent foreshore.

Requirements

Incorporate a Green Shores educational component into the project design, construction or post-construction phases (i.e., monitoring). The applicant must be willing to publicly profile the project and design elements on the Green Shores website. To obtain points under this credit, the applicant must provide the following:

1. A project description/case study for profiling the project on the Green Shores website using the Green Shores project description template provided in the application (format and content must be approved by Green Shores)
2. AND at least one of the following education components for additional points:
    - A comprehensive signage and/or a webpage describing site values, shoreline ecological and physical processes, and an explanation of how the site design works with these features. Signage and/or website should demonstrate how one or more Green Shores credits have been addressed
    - A public outreach program including interpretive walks or tours, public presentation or multimedia series on the Green Shores design elements of the project
    - An identified process for interested professional and community groups to request permission to access the site for the purpose of public education (for private sites only)
    - A summary of the results of site performance as determined by a post construction monitoring program

Credit 10: Outreach and Public Education 3-5 POINTS

See Strategies and Technologies for further detail on these options. The outreach and educational component should occur over a medium to long-term basis (3 year minimum) and the size of the target audience for each element of the program should be stated. If you would like to design an educational component that is not listed in this section, please contact Green Shores and provide a proposal describing the nature of the educational component and how it meets the Green Shores principals outlined in this section.

Outreach – Actions	Points
Case study document, AND	1
One additional educational component, OR	2
Two additional educational components, OR	3
Three additional educational components	4

Submittals

1. The applicable Letter Template signed by the party responsible for carrying out the proposed educational/outreach action.
2. A project description/case study for profiling the project on the Green Shores website using the Green Shores project case study template provided to the project proponent. The description should include design details, images and a description of pre- and post-project conditions at the site, and how and where Green Shores design principles were integrated.
3. Written or multimedia documentation of the outreach and educational initiatives of the project including audience and numbers reached.

Figure 16. Signage along public walkway adjacent to restoration project at New Brighton Park (left) and community field trip illustrating natural bluff processes (right) (Coastal Geologic Services Inc.).

Credit 10: Outreach and Public Education 3-5 POINTS

Strategies and Technologies

The Green Shores program success depends on projects that are accessible and serve as examples for future projects. The suggestions below are a sample of possible actions, but many more options exist. It is important to remember that a single sign, while informative, is not sufficient to fully showcase a Green Shores project with maximum benefit to the community. Signage, if chosen as an education component, should be combined with at least one other element. Examples of potential approaches qualifying for education credits include:

- Public signage on key shore issues, highlighting the Green Shores project design concept and project performance.
- Facilitation of tours for interested professionals.
- Multimedia materials, including on-line, describing the before and after site conditions.
- Interpretive walks for the general public.
- Facilitation of ongoing stewardship activities for residents or the general public (planting of native vegetation/weeding of invasive vegetation, seasonal citizen science surveys).
- Mentorship to other property owners/project proponents who are interested in completing a Green Shores project.
- Informational packages or workshops for future residents, as applicable.
- A partnership with a local school or university to conduct ongoing monitoring to assess design performance relative to Green Shores principles.

Glossary

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) 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 G2).

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 in the Pacific Northwest 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.

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 256 mm (10.1 in) in median diameter. Cobble: a specific size class of gravel sediment 64-256 mm (2.5-10.1 in) in median diameter.

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.

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

Chart Datum – A horizontal plane below which the normal tide will seldom fall, defined in Canada as lowest normal tides and shown as the zero-depth contour on hydrographic charts (see accompanying graphic at end of Glossary).

Coastal Banks or Bluffs – Steep coastal slopes formed of unconsolidated material (sand and gravels) which may conceal underlying rock formations, in contrast to a cliff where rock formations are exposed. Coastal banks are generally less then 5m in height and coastal bluffs greater that 5m in height.

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

Compensation – Restoration, creation/replacement, and/or enhancement of coastal habitat undertaken expressly for the purpose of compensating for unavoidable habitat losses. On-site compensation refers to compensation activities completed within the development site; off-site compensation refers to such activities undertaken in an approved location outside the development site.

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

Contaminants – Harmful or undesirable substances in sediment, water or air that pollute the environment.

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, 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.

Degraded Habitat – Where natural functioning habitat has been impacted by physical (placement of low-valued material), chemical (contaminant), or biological (invasive species) means. Areas with a potential for greater ecological value given proper functioning conditions.

Development Footprint – The total land area of a project site covered by buildings, streets, parking areas, and other typically impermeable surfaces constructed as part of the project.

Drift cell – The nearshore area that includes a sediment source, a transport zone and a deposition zone. The cell boundaries delineate the geographical area within which the budget of

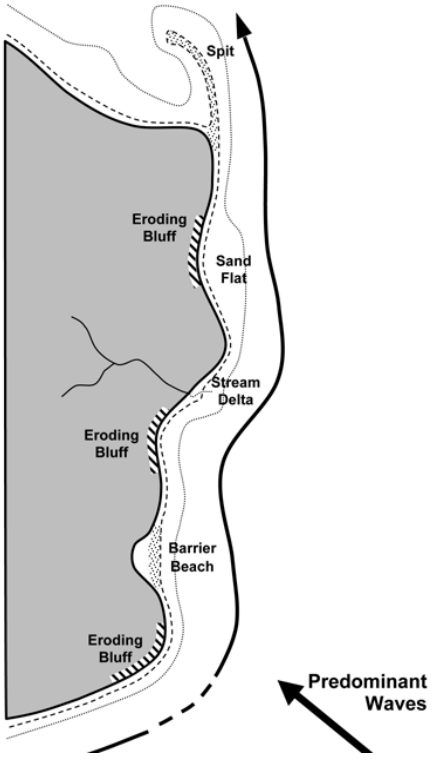


Figure G1. A typical drift cell extending from the eroding bluff/feeder bluff at the bottom to the spit at the top (Shipman, 2008)

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.

Effective Impervious Area (EIA) – The impervious surface area on a site that drains into a conveyance system (ditch or pipe) without any treatment to reduce flows or improve quality. The objective is to reduce EIA as much as possible. For this purpose, runoff can be directed to LID features such as absorbent landscaping (characterized by deeper, organic soils), rain gardens, green roofs, and permeable paving. EIA is the ISA minus the area of surfaces that are treated with some LID measure.

Erosion – The wearing away of land by natural forces; pertaining to a beach, the carrying away 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 be 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, or between seasonal high water and low water levels on lakes (Figures G2 and G3).

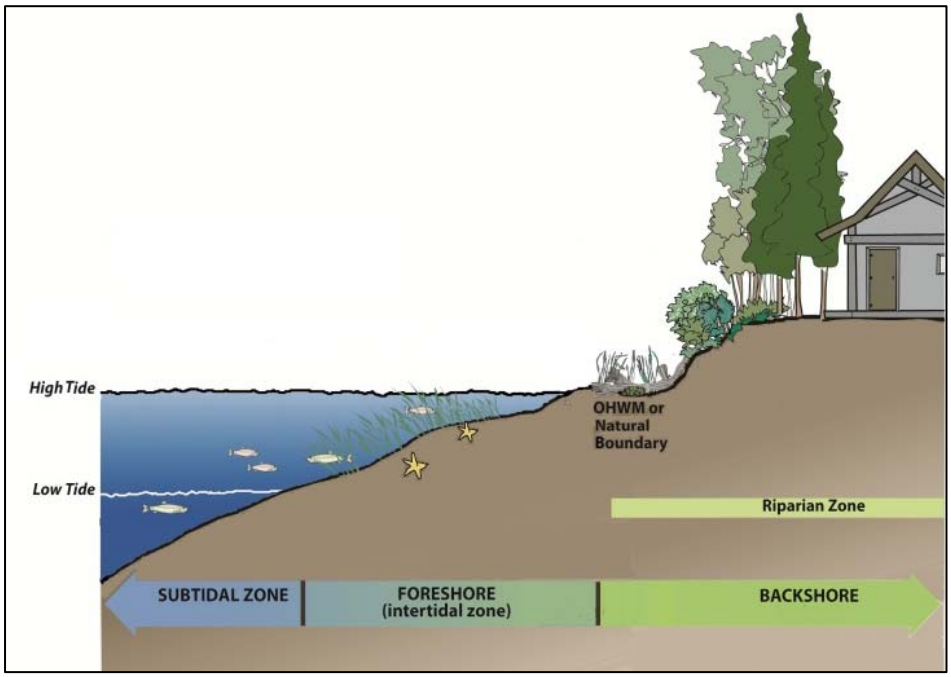


Figure G2. Parts of the shore—marine example (Stewardship Centre for BC).

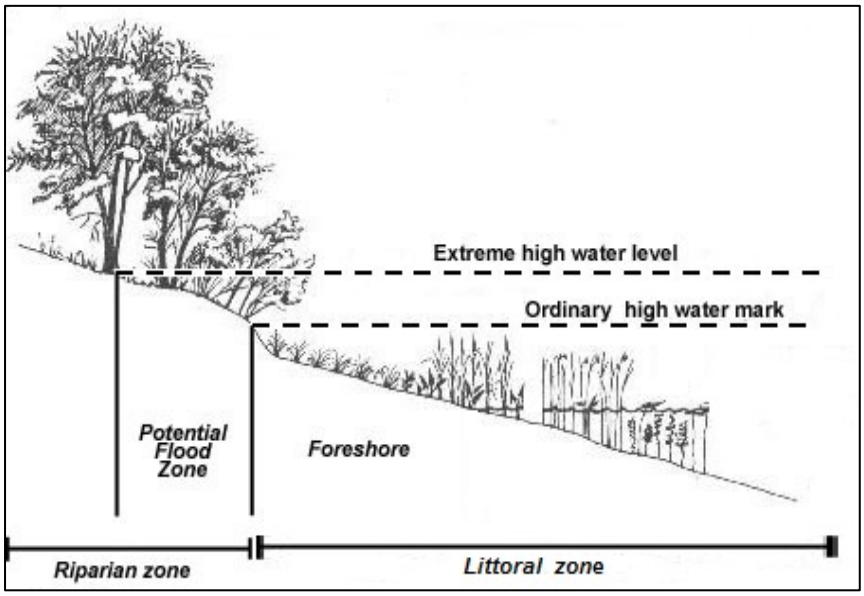


Figure G3. Parts of the shore—lake example (Fisheries and Oceans Canada).

Filled Shore – A natural shore that has been altered by the addition of fill material such as sand, gravel or material of anthropogenic origin.

Geodetic Datum – A vertical control datum referenced to the height of a primary tidal benchmark and generally reflects mean sea level but may vary locally from the site specific mean sea level due to local

tidal conditions. In British Columbia geodetic datum is 1.8-3.5m higher than hydrographic chart datum. In Atlantic Canada, this difference could be between approximately 1 and 8m, depending on the location.

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

Green Field – 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 groynes. It is possible for a previously developed site with an existing natural shore to be designated a green field shore.

Groyne – 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 groyne and erode on the opposite side of the structure.

Hardened Shore – A natural shore that has been altered by the addition of seawalls, retaining walls, riprap, sheet metal, concrete, rock or other 'hard' material or structure.

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 Canadian Hydrographic Service (Figure G4).

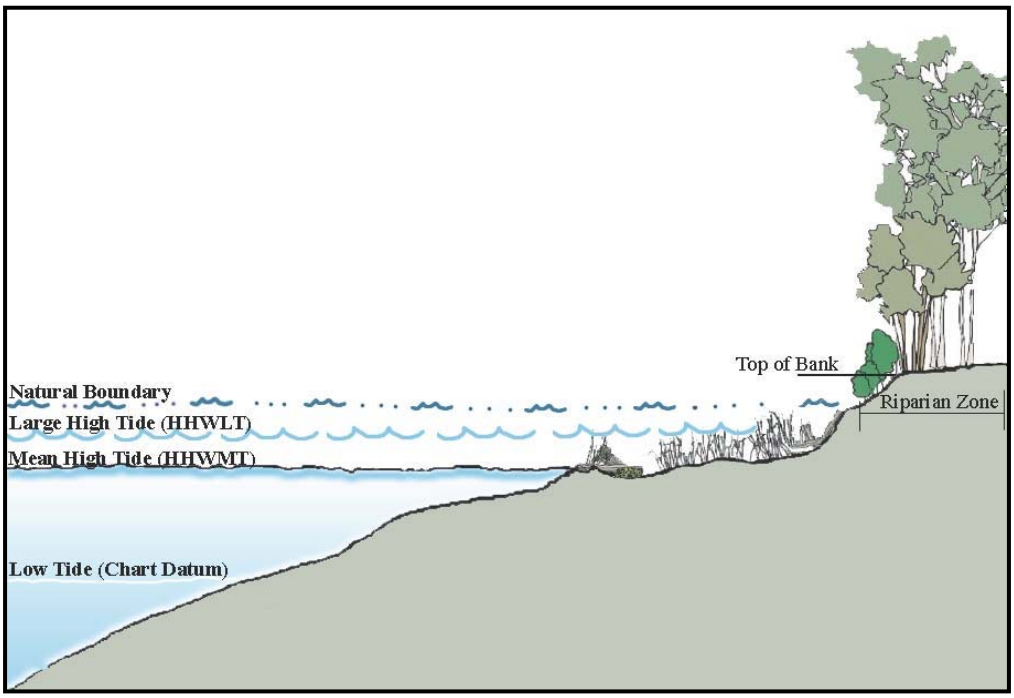


Figure G4. Depiction of the Natural Boundary and other well-known marine tidal datums (developed by Lanarc Consultants Ltd. for Green Shores for Homes).

Impervious Surfaces – Surfaces that do not permit infiltration of water to sub-surface areas and promote runoff of precipitation. The term is used typically to refer to human-made surfaces (e.g., roofs, sidewalks, roads, driveways, etc.) but may also be natural surfaces (e.g., exposed bedrock). The imperviousness or degree of runoff potential can be estimated for different surface materials.

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 (impervious) materials such as shingles, asphalt, concrete, plastic, brick, and stone. The water simply runs off the surface. 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 – The area of the shore that lies between the high and low water levels that is flooded daily by the tide, also termed foreshore.

Invasive Species – A species that is non-native to the ecosystem under consideration and whose introduction is likely to cause economic or environmental harm (including harm to human health).

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

Lifetime of Structure (Design Life) – The period of use as intended by the designer after which it may need to be replaced or repaired. For most building structures, this is 50 years.

Littoral zone – A general term referring to the part of the sea or lake that is close to the shore (Figure G3).

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 (NB) – The visible high water mark of any lake, river, stream or other water body where the action of water is so common and usual and so long continued as to mark on the soil a character distinct from that of its banks (from the *BC Land Act*), its vegetation, and the nature of the soil

itself. In coastal areas this is generally determined as the lower elevation of terrestrial vegetation (see accompanying graphic at end of Glossary).

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 G2 and G3). 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 a 0.3 metre 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 and willows and tall shrubs such as oceanspray 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 (Adapted from GSH).

Park – Any privately or publicly owned land that is set aside as open space for recreation and/or the preservation of habitat, often zoned as a cultural and recreational use and sometimes referred to as a green field. Parks are generally open spaces with little to some development that promotes the recreational or natural activities present in the park (e.g., walkways, picnic shelters, and habitat).

Permanent Structure – Any building or structure lawfully constructed, placed or erected on a secure and long-lasting foundation on land that cannot practically be elevated or moved in accordance with any local government bylaw or approval condition in effect at the time of construction, placement or erection. From the BC Riparian Area Regulation:
http://www.qp.gov.bc.ca/statreg/reg/F/FishProtect/376_2004.htm

Permeable or pervious – Able to transmit or filter water.

Qualified Coastal Professional – An engineer, geoscientist or geotechnical engineer in good standing with his/her professional organization, acting within his/her 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 Stormwater Professional – A water resources engineer in good standing with his/her professional organization, acting within his/her abilities and with demonstrated experience and/or training pertaining to hydrologic and hydraulic processes.

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

Rehabilitation (habitat) – Rehabilitation is intended to make the land useful again after a disturbance. It involves the recovery of ecosystem functions, processes and productivity in a degraded habitat. Rehabilitation does not necessarily re-establish the pre-disturbance condition, but does involve establishing geological and hydrologically stable landscapes that support the natural ecosystem mosaic. Adapted from Willamette Restoration Initiatives, 1999.

Restoration (habitat) – Restoration is the process of repairing damage to the diversity and dynamics of ecosystems. Ecological restoration is the process of returning an ecosystem as closely as possible to pre-disturbance conditions and functions. Implicit in this definition is that ecosystems are naturally dynamic; it is therefore not possible to recreate a system exactly. The restoration process re-establishes the general structure, function, and dynamic but self-sustaining behavior of the ecosystem. While restoration aims to return an ecosystem to a former natural condition, rehabilitation (see below) implies putting the landscape to a new or altered use that supports the natural ecosystem mosaic[19].

Return Period or recurrence interval – The estimated average time between occurrences of an event with a given magnitude, e.g. the N-year return storm is exceeded on average once every N years. This is calculated using historical records, ideally over a minimum duration of 3 times the desired return period.

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 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).

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 – Soil particles suspended in water that settle on stream, lake or sea beds.

Setback – Distance of the nearest major building or infrastructure from the NB/OHWM, or on bluff sites, measured from the bluff crest or break in slope landward. Also: The minimum distance requirement set by a government authority for location of a structure in relation to water bodies, wells, septic fields or other structures.

[19] Willamette Restoration Initiatives, 1999

Shores or Shore Zone – The area of the land/water interface extending from the upper boundary of the riparian area (5-30 m landward of the NB/OHWM) through the intertidal or littoral zone to chart datum elevation (see accompanying graphic).

Shore Length – Length of the shore zone as measured along the NB/OHWM.

Shore Protection Works – A modification to the shoreline for the purpose of protection against erosion.

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.

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

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 10 m (Figure G2).

Stormwater Runoff – Precipitation that does not soak into the ground or evaporate, but flows along the surface of the ground as runoff.

Top of Bank – The point closest to the NB/OHWM of the shore where a break in the slope of the land occurs such that the grade landward of the break is flatter than 3:1 for a minimum distance of 15 m, as measured perpendicularly from the break. From the BC Riparian Area Regulation*:* http://www.qp.gov.bc.ca/statreg/reg/F/FishProtect/376_2004.htm

Upland – The area of the development property above the vertical elevation of the NB/OHWM.

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.

Appendix A: Advisory Committees

Green Shores for Shoreline Development (GSSD) Technical Working Group – 2018-2020

DG Blair
Stewardship Centre for BC

Brian Emmett
Archipelago Marine Research Ltd.

Jim Johannessen, Alison Lubeck, Andrea MacLennan, Tracie Johannessen
Coastal Geologic Services Inc.

GSSD 2018-2020 Technical Advisory Committee
Amanda Broad (BC Climate Action Secretariat)
Dave Harper (British Columbia Institute of Technology)
Grant Lamont (Northwest Hydraulic Consultants Ltd.)
Derek Ray (Northwest Hydraulic Consultants Ltd.)
Paul de Greeff (Murdoch de Greeff Inc.)
Megan Turnock (Lees & Associates)
Deborah Carlson (West Coast Environmental Law)
Brian Emmett (Archipelago Marine Research)
Nicole Faghin (Washington Sea Grant)

GSSD 2018-2020 Rating Credit Peer Review Workgroup
Vincent Leys (CBCL)
Melissa Rutherford (CBCL)
Victoria Fernandez (CBCL)
Jennifer Rocard (CBCL)
Sabine Dietz (Aster Group)
Danika Van Proosdij (Saint Mary's University)
Nancy Anningson (Ecology Action Centre)
Samantha Battaglia (Coastal Action)
Cori Barraclough (Aqua-Tex Scientific Consulting Ltd.)
John Sommerville (Natural Resources Canada)
Brianne Labutte (Comox Valley Regional District)
Luke Sales (Town of Qualicum Beach)
Lily Whitehead-Delong (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development)

Green Shores for Coastal Development (GSCD) Technical Working Group 2007-2010

Brian Emmett
Archipelago Marine Research Ltd.

John Readshaw
SNC Lavalin Inc.

Harriet Rueggeberg

Gretchen Harlow

GSCD 2007-2010 Technical Advisory Committee

Erik Lees (Lees and Associates Landscape Architects)
Scott Northrup (Fisheries and Oceans Canada)
Alex Zimmerman (Applied Green Consulting, Canada Green Building Council)
Michelle Gaudrey (Fraser River Estuary Management Program)
Barron Carswell (British Columbia Ministry of Environment, Ocean and Marine Fisheries Branch)
Mike Rogozinski (Real Estate Foundation of British Columbia)
Doug Myers (Puget Sound Action Team)
Barry Janyk (Mayor of Gibsons, British Columbia)
Deborah Conner (Georgia Strait Alliance)
Chris Jackson (Islands Trust)

GSCD 2007-2010 Rating Credit Peer Review Workgroup

Jim Mitchell (Coastal Engineer)
Michael Tarbotton (Triton Consultants Ltd.)
Gary Williams (G.L. Williams and Associates)
David Reid (HB Lanarc Consultants)
Scott Murdoch (Murdoch Landscape and Design Ltd.)
Don Howes (DA Howes and Associates)
Peter Hardcastle (Hillel Architecture)
Catherine Berris (Catherine Berris and Associates)
Patrick Lucey (Aqua-Scientific Consulting Ltd.)
Lindsay Jones (Integrated Land Management Branch)

GSCD 2007-2010 Pilot Program Assessors

Rob Russell (Habitat Biologist)
Pat Harrison (Landscape Architect)
Cara MacDonald (Landscape Architect)
Sarah Bonar (Chatwin Engineering)
Susan Davidson (SeaScience)
Rowland Atkins (Golder Associates)
Berly Allen (Cypress Creek Design)
Jim Mitchell (Coastal Engineer)
Gina Lemieux (Archipelago Marine Research)
Brendan Holden (Engineer)
Scott Murdoch (Murdoch deGreef Inc.)
Jodi Harney (Coastal Geologist)
Kathy Dunster (Unfolding Landscapes)

STEWARDSHIP CENTRE

FOR BRITISH COLUMBIA