A Landowner’s Guide to Protecting Shoreline Ecosystems

Prepared by Kris Nichols, Island Planner

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*Front Cover Photo Credit - Photo: Peter Kilpatrick, Ravenhill Construction Inc. (Soft Shoreline Stabilization Shoreline Master Program Planning and Implementation Guidance)*
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Introduction

The purpose of this information guide is to provide an introduction to techniques that landowners should consider when protecting and enhancing their waterfront properties.

Islands Trust Area shorelines are part of what define us and our island landscapes by providing highly valued coastal areas where we live, work and play. Maintaining the integrity and ecological function of the natural shoreline is crucial to the survival of many marine and terrestrial species. The Gulf Islands, located in the Salish Sea, are surrounded by salt water. Some are even fortunate to have freshwater lakes within their boundaries. Shorelines are abundant and therefore the opportunities to enhance and protect them are also abundant.

Protecting the Shoreline

The construction of seawalls is a significant environmental issue on many of the Gulf Islands. They have been continuously constructed for a variety of reasons including, but not limited to, extension of usable property, protecting property and protecting the shore from coastal erosion. Coastal erosion is a natural process. Waves move and sort the beach sediment from one place to the next, causing a bluff to recede here and a beach to aggrade there. This coastal erosion process is unpredictably such that a given shore may be stable for many decades and then erode significantly in one season and then remain stable in its new configuration for many decades. Building structures too close to the shore places them at risk and creates both the real and a perceived need for protection measures. Halting this natural process on one parcel can result in incremental degradation of various natural processes both on and off site, the cumulative effect of which can result in widespread damage to ecosystem functions.

The construction of seawalls influences natural coastal processes and ecology. There are many alternatives to seawalls that exist for managing risk to structures and infrastructure posed by coastal erosion, including: the use of best management practices, structure relocation, and implementation of “soft shore protection” project designs. Soft shore protection projects contrast from hard armor by preserving natural coastal shoreline dynamics that are negatively impacted by seawall type structures. Successful soft shore protection project designs must be informed by a thorough understanding of specific site conditions and work within the range of current and historical coastal processes. This approach contrasts seawall type (hard) designs where “one design fits all” is the standard and the overarching goal is to create a fixed barrier between the land and the water.
There are two general types of development that are addressed in this information guide:

**Whole Site Development:** The proposed development extends over the entire waterfront lot and includes activities such as site design, clearing, landscaping, building construction/deconstruction, stormwater and septic management, as well as any activities associated with riparian/shoreline development (see below).

**Riparian/Shoreline Development:** The proposed development occurs anywhere from the lower limit of the intertidal zone (in a marine environment) or from the littoral zone (in a freshwater environment) to the upper side of the riparian zone. (See “Terms” in Appendix A) Activities that apply include building and landscaping in the riparian zone, shore protection (e.g., seawalls and seawall removal, soft shore protection), shore access and overwater structures.
The Spectrum of Shoreline Protection

There are a number of ways to protect the shoreline ranging from passive techniques that require minimal or no engineering to engineered soft shore protection projects to hard shore armor (e.g. seawalls). Some passive techniques are as follows:

- Managing surface and groundwater; preventing the saturation of the soil in the bank or the surface erosion caused by direct runoff.
- Vegetation management; maintaining natural bluff or bank vegetation so that roots hold the soil together and foliage intercepts rainfall and breaks the impact of drops on the surface.
- Relocation of infrastructure; moving the house, building or road away from an eroding bank rather than trying to protect it in place.

These approaches are generally inexpensive in comparison with engineered solutions and are seen as being beneficial for erosion control with minimal impact on natural processes.

Some engineered shore protection techniques are as follows:

- Beach nourishment; the addition of sand or gravel to a beach can be used as a protection or restoration technique where feasible. When designed to function with natural coastal processes this technique has low to moderate impacts and requires relatively little mitigation.
- Large wood; strategic placement of logs and root wads that maintains/enhances natural processes, such as recruitment of drift logs, in order to build up the backshore while maintaining dynamic near shore processes. If appropriately designed and installed there are few impacts from the technique.
- Reslope/revegetation; creating or maintaining a stable bank slope and using vegetation to stabilize it. Generally, there are few impacts from this technique.
- Seawall removal and/or restoration of natural beach. Of the formal techniques, this has the fewest impacts and will restore natural beach processes.
- Hard armour; rock revetment (placement of stationary sloping rock, rip rap) and vertical seawalls (constructed of concrete, sheet pile, rock, or wood). These techniques are used at high risk sites but will fundamentally alter natural beach processes and therefore require substantial mitigation.

The impacts associated with a given design technique can be minimized or avoided if the alternative selected is feasible for the site and designed and built appropriately (See Table below). For example, if forage fish spawning is documented or is very likely to occur at the site, then a design alternative should be selected that does not impact upper intertidal spawning.
habitat. The table below can be referenced to identify the range of impacts associated with each design alternative.

**Figure 1: Impacts and duration of impact associated with each design technique:**

<table>
<thead>
<tr>
<th>Design Technique</th>
<th>Impact</th>
<th>Range of Duration</th>
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<tr>
<td>Beach nourishment (BN)</td>
<td>Beach disturbance from equipment, materials staging and sediment placement</td>
<td>Temporary</td>
</tr>
<tr>
<td></td>
<td>Burial of current substrate (smothers meiofauna (e.g. tiny mussels and worms) Commonly coarser substrate is applied</td>
<td>Intermediate</td>
</tr>
<tr>
<td></td>
<td>Can steepen beach profile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drift sills can temporarily impair sediment transport</td>
<td></td>
</tr>
<tr>
<td>Large wood (LW)</td>
<td>Drift sills bury portion of intertidal beach</td>
<td>Permanent</td>
</tr>
<tr>
<td></td>
<td>Degraded salmonid migratory habitat</td>
<td></td>
</tr>
<tr>
<td>Bank Re-slope/and revegetation (RE)</td>
<td>Beach disruption from equipment access, materials staging and placement</td>
<td>Temporary</td>
</tr>
<tr>
<td></td>
<td>Disturbance and upland habitat loss associated with regrading bank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sedimentation associated with vegetation clearing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Changes in upland surface water flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetation takes time to mature and effectively function as erosion control</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Seawall removal (BR)</td>
<td>Beach disruption from equipment access, materials staging and placement</td>
<td>Temporary</td>
</tr>
<tr>
<td></td>
<td>Sedimentation/turbidity associated with removal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disturbance of beach substrate during subgrade excavation</td>
<td></td>
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<tr>
<td>Hard Armor:Rock revetment (RV)</td>
<td>Beach disruption from equipment, materials staging and placement</td>
<td>Temporary</td>
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<tr>
<td></td>
<td>Precludes sediment input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buries portion of upper beach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degrades salmonid migratory habitat</td>
<td></td>
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<tr>
<td></td>
<td>Coarsened sediment composition</td>
<td></td>
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<tr>
<td></td>
<td>Can steepen beach profile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precludes LWD input and deposition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riparian vegetation alteration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altered wave action and littoral drift</td>
<td></td>
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<tr>
<td>Hard Armor:Vertical bulkhead (VB)</td>
<td>Beach disruption from equipment, materials staging and placement</td>
<td>Temporary</td>
</tr>
<tr>
<td></td>
<td>Increased turbidity</td>
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Choosing the most appropriate course of action for a site from these various alternatives listed above begins with a careful assessment of the site and conditions and having an understanding of the supporting coastal ecosystem processes. As a landowner, it is important to use site characteristics and coastal processes to inform appropriate designs for your property.

The need for professional assistance to develop or redevelop your property:

Many shoreline projects require assistance from one or more professionals. Professionals can assist with site assessment and alternatives analysis to determine the need for shore protection and identify the technique that best suits the conditions at a given site. These trained, experienced consultants and contractors can help you with design, permitting, building, operating and maintaining a cost effective, durable, attractive and environmentally friendly project. Depending on the specifics of your project and site, you may need a coastal/shoreline engineer or geologist, biologist, geotechnical expert, landscape architect, site designer, machine operator and/or permit specialist. Some companies do all of these things while others specialize in one or two. The best way to start is by identifying priorities for your project and its intent – is it erosion protection, landscape design, redevelopment, access or drainage improvement?

In addition to searching out the professional assistance required to do the work, it is important that you check with your Island Planner to determine what may be required from an Islands Trust perspective. In addition, they have likely come across similar projects in the past and can assist you in identifying the type of professional you require and answering questions. See the following for Islands Trust contacts: http://www.islandstrust.bc.ca/connect/contact-staff.aspx

Some approaches as mentioned earlier have greater natural adaptive capacity and are likely to sustain a moderate rise in sea level (~0.3 m) with little alteration. Whereas other approaches may be more likely to fail or further impact the beach as shorelines migrate inland (see Table below). An example of design technique with high natural adaptive capacity is beach nourishment along a barrier beach, in which the foreshore and backshore naturally migrate.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Natural Adaptive Capacity</th>
<th>Example</th>
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<tr>
<td>Beach nourishment</td>
<td>Moderate Rise (~0.3 m)</td>
<td>Barrier beach</td>
</tr>
<tr>
<td>Riparian buffer</td>
<td>High</td>
<td>Natural drainage</td>
</tr>
<tr>
<td>Dispersal of LWD</td>
<td>Variable</td>
<td>Beach stabilization</td>
</tr>
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landward as sea levels rise. Natural beach profiles with intact sediment supply are assumed to be the most resilient.

Figure 2: Typical (installation) costs and benefits associated with different design techniques. L=Low, M=Moderate, H=High.

<table>
<thead>
<tr>
<th>Design Technique</th>
<th>Cost</th>
<th>Slows Erosion</th>
<th>Benefits Processes</th>
<th>Adaptive Capacity</th>
<th>Maintenance Cost</th>
<th>Maintenance Interval</th>
</tr>
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<tbody>
<tr>
<td>Beach nourishment (BN)</td>
<td>M</td>
<td>H</td>
<td>M-H</td>
<td>H</td>
<td>L-M</td>
<td>L-M</td>
</tr>
<tr>
<td>Large wood (LW)</td>
<td>L-M</td>
<td>M-H</td>
<td>M</td>
<td>L-M</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Re-slope/ revegetation (RE)</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M-H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>Seawall removal (BR)</td>
<td>L-M</td>
<td>NA</td>
<td>H</td>
<td>H</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Hard Armor: Rock revetment (RV)</td>
<td>M-H</td>
<td>H</td>
<td>None</td>
<td>None</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Hard Armor: Vertical bulkhead (VB)</td>
<td>M-H</td>
<td>H</td>
<td>None</td>
<td>None</td>
<td>H</td>
<td>L</td>
</tr>
</tbody>
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Green Shores for Homes Program

The majority of the information provided in this document taken from the Green Shores for Homes program that focuses on positive steps to reduce the impact of new and existing residential development on shoreline ecosystems. The program is based on four guiding principles that make up the sections of this booklet:

1. **Shoreline Physical Processes**: Actions aimed at protecting or restoring natural physical processes that are vital to the health of shoreline environments.

2. **Shoreline Habitat**: Actions to protect, restore and enhance aquatic and riparian habitats.

3. **Water Quality**: Actions to reduce or eliminate the amount of sediment, chemical and organic pollutants discharged to lakes and marine waters in rainwater runoff.

4. **Shoreline Stewardship**: Actions that reflect general best management practices and that help to support public values of shorelines.

**Green Shores for Homes** is a collaborative initiative of the Islands Trust, San Juan County and the City of Seattle to explore ways to recognize land owners using Green Shores Design in the development, or redevelopment, of their property. [www.greenshores.ca](http://www.greenshores.ca)
CHAPTER 1 - WHERE TO START?

Creating a Site Design Plan

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

**Homeowner Benefits:** Developing a Site Design Plan will require a planning and design process to properly size and locate all design initiatives on the existing site. The planning and design process allows homeowners to fit their project to their existing site and to avoid costly alterations to existing site conditions. Completing a simple design plan early in the design process will help identify potential problems and design shortcomings before they become a real problem. Rather than react to a problem, homeowners can use this to design more efficient homes, multifunctional landscapes and greener shorelines.

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

**How to Accomplish:** Develop a Site Design Plan, starting with the Pre-Design Site Assessment/Plan and incorporating proposed development and site changes, including: building areas and locations, patios, driveways, pedestrian circulation paths, access points, overwater structures, shore protection measures, vegetation planting, and soil amendment, etc. Fit these elements into the site while maintaining critical existing site features and processes identified in the pre-design site assessment. See Diagram 1 for an example of a site design plan.
Environmental Management Plan for Construction

**Goal:** Develop and implement a plan to limit disturbances and address erosion, sediment and pollutant control on-site during construction.

Sedimentation of adjacent water bodies is a concern when erodible materials are exposed. This occurs particularly during construction. In addition, materials such as paint, drywall compound, concrete wash and glues need to be managed to prevent pollution. All proposed activities need a construction management plan to show how sediment/runoff and pollutants are managed during the construction phase of the project.

**Homeowner Benefits:** Limiting disturbance of existing vegetation and compaction of soils is the best and least expensive form of stormwater management. Managing construction activities and related waste materials before and during construction is simpler and less costly than clean-up and restoration after-the-fact. A healthy nearshore marine ecosystem and clean fresh water streams contribute to the allure of living on the shoreline. All landowners have a role in preserving and improving shoreline ecosystems. All waterfront owners want clean water, healthy marine wildlife and clean beaches – these not only contribute to human health but can also increase property values.

**Environmental Benefits:** The main benefit is the prevention of runoff of construction-related sediment and pollutants into local ground and surface water. Groundwater is one of the most important resources on an island and needs to be protected. Numerous studies have shown that vegetation removal and run-off from upland development is a primary cause of degraded marine and nearshore water quality. Upland development can increase land-based erosion and land slumping, resulting in sedimentation and smothering of nearshore flora and fauna. Limiting disturbance combined with containing and treating sediment or pollutant-laden water, and containing, reusing, or recycling construction chemicals and materials will help to reverse this trend.
Critical or Sensitive Habitats

**Goal:** Avoid disturbing or destroying critical or sensitive habitats.

Local, provincial and federal laws identify and designate critical or sensitive habitats in an effort to ensure the conservation and protection of rare, endangered, threatened, or priority species. Some islands have specifically identified these areas through the establishment of development permit areas.

For British Columbia, this includes:

- Areas providing important feeding, resting, spawning, nesting, or rearing habitat for species designated under the federal *Species at Risk Act* or the BC *Wildlife Act*, or identified as “red” or “blue” listed species by the BC Conservation Data Centre;
- Environmentally Sensitive or Significant Areas identified by the federal, provincial, regional or municipal government in your area;
- Shore and marine areas identified as Important Bird Areas by Nature Canada and Bird Studies Canada;
- Other valued foreshore habitats including estuaries, fresh and saltwater marshes, wetlands, eelgrass beds, kelp beds, clam beds, spawning and rearing areas for fish, and feeding and resting areas for seabirds and marine mammals.

*Diagram 2: From City of Campbell River Marine Foreshore Habitat Assessment and Restoration Plan 2011, p. 84*
CONSIDERING SHORELINE PHYSICAL PROCESSES

Shoreline processes refer to the interaction of water, wind, waves and the shore that shape our diverse beach, bluff, cliff and estuarine areas. The ultimate goal is to preserve and, where needed, restore processes that benefit shoreline ecosystems and the many organisms that live in them.

Setback Considerations

Goal: Construct homes and other major improvements at distances far enough from the active beach or bluff crest to avoid the need for seawalls or other structural shore protection over the life of the improvements.

An adequate setback is the single most effective action to save money, avoid anxiety and protect shoreline habitat over the long run. Most islands have setbacks, established through bylaws, for buildings or structures from the water; however, these may not be sufficient to protect the building or structure from an active beach.

Homeowner Benefits: Choosing a substantial setback distance can save a lot of expense over the life of a house. These savings may not be reaped in the short term, as erosion and land slumping typically occur gradually and/or intermittently. However, the savings by avoiding the installation of a seawall, soft shore protection, or other actions to mitigate erosion and shoreline hazards can be quite large.

Environmental Benefits: Using a building setback sufficient to last for 75 or more years of safe use of a property without installing “hard” measures is among the most effective methods of maintaining natural processes and protecting ecological functions of shorelines. Setbacks address the root causes of habitat degradation, and not just the risk or consequences of having an insufficient setback from an eroding shore.

Seawall Removal

Goal: Reduce or remove any type of shore armor (collectively called seawalls).

Seawalls and shore armor include seawalls, revetments, riprap, gabions and similar along-shore structures designed to protect against wave attack or serve as a retaining wall at the shore. Seawalls have been constructed on all types of shorelines, but are most common along erodible beaches and non-bedrock bluff sites.

Seawall removal at feeder bluff sites restores the natural sediment supply, potentially providing the most benefit to shoreline processes and habitats. Seawall removal may not be feasible on small lots with limited space between a house and the shore and no room to move the house.
back. A qualified professional (coastal geologist or engineer) can advise on the stability of a site and the effect of seawall removal prior to considering this action. It may be possible to move part of a seawall or move a seawall back to restore part of natural beach.

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

- Seawalls have a finite life expectancy and require maintenance or replacement over time. Seawalls can fail either incrementally or catastrophically for a number of reasons including undermining of the base, battering by drift logs, loss of integrity due to rot or other deterioration, or flanking erosion at the ends of structures. In addition, future sea level rise may accelerate damage to seawall structures.
- A seawall often creates a barrier to the shoreline for a property owner; replacing it with a soft shore eliminates that barrier.
- Sand and pebble beaches are highly valued, but seawalls often block the replenishment of finer beach materials, changing a sandy beach into a boulder, cobble one.
- Although aesthetic values are hard to quantify, the removal of non-natural materials such as concrete and other angular structures from an otherwise natural beach environment is generally viewed as an improvement.
- Wildlife tends to favour beaches with adjacent vegetated areas, which are almost always increased in quantity and quality following seawall removal. This leads to increased wildlife use and increased wildlife viewing opportunities.

Over the long run, it is often more cost effective to relocate structures landward than to build, mitigate, and maintain shore armoring.

**Environmental Benefits:** Seawall removal is one of most beneficial actions that can be performed on an armored waterfront property, in terms of improving natural processes and nearshore habitat conditions. These high impact structures have a broad suite of impacts on shorelines:

- Seawalls hinder shoreline processes such as sediment supply and the transport and recruitment of large woody debris (LWD) to varying degrees, but particularly at sites where interactions with wave and tidal forces are greatest.
- Seawalls impede the connectivity between terrestrial and marine ecosystems in which detritus such as beach wrack accumulates, large woody debris is recruited and deposited, forage fish spawning occurs, and several important nearshore habitats are found.
• Seawalls can indirectly impact down-drift shores by decreasing sediment supply and increasing erosion. The physical presence of a structure can reduce or block the movement of upland and bluff sediment from feeder bluffs, which provide sediment to the beach through erosion and landslides. Blocked sediment supply affects both on-site and down-drift beach profiles and substrate composition—often turning sand or pebble beaches into cobble and rock.

• Many nearshore fish and wildlife require functioning high intertidal habitats to provide sources of food, migration corridors, cover/micro-climate effects, and spawning habitat. Seawalls can bury or cause the loss of these important habitats. The removal of seawalls allows for the recovery of nearshore habitats previously buried beneath or behind armor.

• Additional adverse impacts depend on the level of impaired cross-shore connectivity (i.e., extending or running perpendicular to the shoreline) resulting from the structure. These cross-shore impacts can include loss of overhanging riparian vegetation, reduced large woody debris (LWD) recruitment and storage, altered groundwater regimes (Brennan 2007), reduced insect input, and loss of upper beach microhabitats. Each of these adverse impacts has direct and indirect effects on ecosystem components including marine riparian areas, forage fish spawning habitats, eelgrass beds, and shellfish areas.

Photo 1: Seawall removal before and after – Lopez Island WA (credit Peter Kilpatrick, Ravenhill Construction Inc.)
Moving Seawalls Back

In some cases, limited lot size may dictate the need for some sort of hard protective structure to protect a home. In these cases, however, it may be possible and advantageous to replace a deteriorating seawall with a new seawall further back from the natural boundary. This can allow room for restoring shoreline habitat AND put the seawall where it will require much less maintenance or be prone to damage. By moving a seawall back, a homeowner can gain a beach with its many amenities as well as re-establish habitat for shoreline flora and fauna.

How to Accomplish

Seawall removal projects can involve single or multiple properties and can take a variety of approaches:

- A seawall is completely removed and the beach profile is allowed to be restored naturally by waves rather than by re-grading. Outside assistance is often required for demolition and disposal.
- A seawall is partially removed and the shoreline modified. This typically requires engineering design of return walls to connect retained portion of seawall to the bluff or uplands, or similar protective structures (e.g. LWD placement) to maintain structural integrity onsite and avoid erosion hot spots on adjacent shores. This could reduce the length of shore armor to only what is required to protect infrastructure in close proximity to the shore, or it may entail moving armor inland substantially to a higher elevation well above maximum high water.
- If the armor currently infringes on intertidal habitats, removal often includes shore enhancement elements such as beach nourishment, re-vegetation and/or LWD placement (Clancy et al., 2009). At a minimum this involves filling all depressions with appropriate beach sediment and some amount of native vegetation planting.

Seawall removal projects should maximize the restoration of natural processes while balancing the need for human safety. A removal or modification design needs to balance risk to life and property with the enhancement of shoreline processes and habitat quality and quantity. Full
seawall removal and enhancement is the goal of these projects, unless geologic/engineering analyses recommend the use of lower impact shore protection at the site.

Finally, note that removing a seawall and replacing it with a soft shore (see above) is not a zero-maintenance solution. Any soft shore protection requires maintenance or replenishment in several years, depending on the level of activity of shoreline processes.

![Photo 2: Seawall removal – before, during and after (credit: King Co. Water and Land Resources Division)](image)

**Groin/Beach Structure Removal**

**Goal:** Remove groins and other types of structures that extend perpendicular to the shoreline (cross-shore) and impede sediment transport or tidal circulation, where removal is feasible and will restore physical processes.

These types of structures include groins, boat ramps, jetties, large stormwater outfall pipes, and other structures which extend across the shore and trap littoral sediment on one side or significantly alter tidal circulation. Groins that extend into the subtidal typically do not affect long-shore sediment transport, and in fact, may provide reef-type habitat. In most cases, subtidal groins or subtidal portions of groins should not be considered for removal.

Groin removal is also not feasible in locations where removal would cause significant up-drift or down-drift erosion in developed areas. For example, if a house is already located very close to a beach that is being held in place by a groin, it may not be feasible to remove the groin as part of renovations on the property. A qualified professional (coastal geologist or engineer) can advise on the stability of a shoreline and the effect of groin removal on that stability prior to considering this action.

Several beaches enhanced through beach nourishment have utilized “drift sills“, which are low-elevation groins with the up-drift beach filled to the top of the groin with nourishment sediment. These drift sills were used in areas with impeded natural processes and/or improvements located very close to moderately energetic shores. Removal of drift sills is typically not advised as the beach nourishment sediment may become unstable.
Finally, be aware that since it involves working in the foreshore and fish habitat, groin removal will require permits or other approvals from regulatory agencies. Check your proposed project with local, provincial or federal authorities before getting started. Also be aware that removing a groin may affect your neighbor’s property – positively or negatively. If you suspect that groin removal might lead to a negative impact next door, seek the advice of a qualified professional before getting started.

![Photo 3: Examples of groins (Credit: H. Rueggeberg, M. Henigman)](image)

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

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

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

The impacts associated with groins include:

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

Decreased sediment supply can affect on-site and down-drift beach profiles and substrate composition. Many nearshore fish and wildlife require functioning high intertidal habitats to provide sources of food, migration corridors, cover, and spawning habitat. Groins and other cross-shore structures can cause the burial of important habitats such as forage fish spawning areas (Rice 2006).

Additional adverse impacts depend on the level of impaired along-shore connectivity resulting from the structure, which can include loss or reduction in the transport of sediment and large woody debris (LWD). Each of these impacts has direct and indirect effects on marine riparian areas, forage fish spawning habitats, eelgrass beds, and shellfish areas (Clancy et al. 2009).

How to Accomplish

Groin removal typically involves pulling out a structure, filling all depressions with appropriate beach sediment, and planting native vegetation if appropriate. It is important to remove all portions of the structure, including materials buried below grade, such that buried material does not become exposed on the beach surface over time. This avoids armor material or debris from surfacing in the future following adjustments in beach elevation.

Removal of groins of moderate or larger size can change accretion and erosion patterns. Assess shoreline processes at and around your site and how they might be changed as part of design plans (see Prerequisite 1.1 and 1.2). For small removal projects, do a general assessment of the effects on local erosion and deposition on your shoreline and your immediate neighbors’ shorelines; for larger removal projects, do a broader assessment of implications for the shoreline in your area – see Clancy at al. (2009) for details. Items to include in your assessment are:

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

You can determine if sediment transport is blocked or impeded by observing the beach level on each side of the structure to see if one side is higher by 1.5 ft. (0.5 m) or more.
Soft Shore Protection or Enhancement

Goal: Where shoreline erosion control is needed, construct soft shore protection rather than hard engineered shore protection structures.

Soft shore protection refers to installing natural, flexible shoreline material where erosion control is needed. Soft shore protection approaches may use beach “nourishment”, logs and large natural woody debris, vegetation and re-sloping a bank or bluff. All these methods are described in more detail in the “How” section below. Often these soft shore protection approaches are used in combination to augment site stability or to address different issues in different parts of a site. Using soft shore protection to address shoreline erosion is an environmentally friendly alternative to hardened measures.

Beach enhancement refers to actions, other than seawall removal (credit 2.2) that augment natural features of shoreline systems that may be degraded. Typical beach enhancement projects include adding beach sediment to enlarge a beach, pocket beach or marsh area where these habitats are moderately impacted. Ideally, beach enhancement designs would replicate historic conditions or those from a nearby unaltered beach with similar dominant drivers (waves, geology, etc.).

Soft shore protection projects are most successful on more protected shorelines and typically not feasible where there are high wave energy and high erosion rates. In areas that are unsuitable for soft shore protection, moving structures further landward should be considered over hard engineered structures.

Any beach nourishment proposed to extend below the natural boundary must be reviewed by Fisheries and Oceans Canada (due to the potential impact on fish habitat) and provincial land authorities (the foreshore is owned and managed by the Provincial Crown), as well as be subject to local government regulation. Check your proposed plan with local authorities (DFO, Islands Trust) if you plan to work in the foreshore.

Photo 4: Beach nourishment before and after – Marchs Point, Skagit Co. WA (Credit: Coastal Geologic Services)
**Homeowner Benefits:** Soft shore methods can be effective in protecting structures that are threatened by erosion while avoiding the typically more expensive seawall and related types of engineering approaches. Additionally, the use of soft shore protection as compared to hard approaches often results in increased resilience and greater aesthetic appeal of the finished product, particularly after several years when vegetation has been established and the site has naturalized. Enhancement projects typically also increase the available beach or salt marsh area, which allows for additional recreational and wildlife observation opportunities. All of these effects improve property values.

**Environmental Benefits:** Soft shore methods can provide effective erosion control on suitable sites where protection is required, while not impacting geomorphic processes or substantially degrading nearshore habitats.

Properly designed soft shore projects work with natural conditions, and compared to hard shore protection, offer a suite of more desirable outcomes. For instance, beach nourishment may provide spawning habitat for forage fish species such as sandlance and surf smelt, food sources for salmon and other food fish species, birds, and marine mammals. Unlike seawalls, beach nourishment contributes to natural sediment transport and shoreline habitats.

Soft shore beach enhancement projects can restore or augment shoreline features to provide a net gain in shoreline habitats and ecological services. In some cases, enhancement actions can mitigate for the loss of habitat, such as creating a lagoon where an historic lagoon had been filled nearby and constraints on the original site prevent full restoration.

**How to Accomplish**

Soft shore projects should be designed and supervised by a qualified coastal engineer or geologist. The project must employ a design that allows for the continuation of natural processes such as littoral drift and riparian vegetation growth, and not completely alter beach or backshore areas.

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

**Beach “nourishment” or “replenishment”** is a common means of soft shore protection in which sediment lost to erosion is replaced or augmented with imported sediment, typically from an upland source. Beach nourishment material should resemble native beach substrate in both size and composition, but may be slightly larger or coarser. No “fines” – grain size less than 0.5
mm – can be present in nourishment material. Gravel is used most commonly as it is less mobile than sand.

Beach nourishment can protect beach resources by creating a larger sand or gravel reservoir, moving the shoreline seaward. In areas where sediment supply has been substantially reduced due to armored bluffs, beach nourishment can mitigate the lost sediment supply and enable local beaches to more closely resemble their historic sediment composition.

If forage fish spawning has been documented on the subject beach, soft shore protection projects must not bury these habitats without designing in their replacement. Use an appropriate sediment composition (rich in 1-7 mm sized sediment) to assure that spawning habitat is enhanced rather than degraded. Up to 5 years is needed for this to come to fruition at more impacted sites. Monitor the project to assure that spawning habitat is preserved or enhanced.

Beach nourishment differs from fill because it is mobile and permeable, and as such, will likely need to be replenished from time to time.

**Logs or other large woody debris (LWD)** are placed to add complexity and elevation to a beach nourishment project, and to help to hold added beach material. In some cases, LWD pieces are anchored to buried boulders or concrete blocks. Do NOT use treated LWD in soft shore protection projects.

Logs and LWD are typically only used above the higher high tideline to protect the area landward of the beach during storms at low to moderate wave energy sites. Logs have only been used successfully at lower elevations on the beach in low wave energy sites (less than 3.2 km fetch, or open water distance).

**Vegetation** is often used for soft shore protection in conjunction with other approaches. Do not bury backshore vegetation without replanting. Planting with salt-tolerant species like native dune grass and native trees and shrubs is focused on the area immediately above the normally inundated beach. On low energy shores with fine-grained sediment, salt marsh vegetation can be installed or enhanced to reduce intermittent erosion, although this would typically not be a site that would require soft shore protection and would instead be considered beach enhancement.

**Bank re-sloping** reduces the slope of an unstable bank and smoothens out landslide scarps or other features that are particularly steep and unstable. This may require installation of erosion control fabric on the slope in very unstable slope sites. To be successful over time, re-sloping is immediately followed by intensive planting of native vegetation selected for high root strength.
Resloping may not be feasible on small waterfront lots where there is little room between the bank and major structures, or room to move the structures back.

**Up to 20% hard elements where necessary:** Soft shore protection projects may need to employ limited amounts of rock in sites with moderate to high wave energy, severely impacted shoreline processes and/or a minimal available setback (refer to Johannessen 2000 for more detail). However, do not include significant amounts of rock armor except in limited areas, and never use vertical elements such as cement walls, lock block, etc.

Rock drift sills (sometimes called “hard points”) are low elevation groins that are filled with beach nourishment sediment on the up-drift side. They may be used, but only where required to support beach nourishment, and must not exceed 20% of the total project length.

Note that soft-shore protection measures are not zero-maintenance solutions to shore erosion. Any soft shore protection may require maintenance or replenishment every few years, depending on the level of activity of shoreline processes.

**Managed Structure Retreat**

**Goal:** Move an existing structure inland to avoid shoreline erosion and adapt to ongoing or predicted shoreline recession.

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

**Homeowner Benefits:** Moving a structure avoids substantial short or long-term expenses for shore protection and the loss of valuable assets. Moving a building within a lot can often cost less than building protective works.
Environmental Benefits: Movable houses and other structures allow the homeowner to avoid an array of negative impacts on shoreline processes and habitats that comes with construction and maintenance of shore protection and other erosion control measures. This single action, although not necessarily the easiest, would have a widespread and long-lasting benefit if needed in the future.

How to Accomplish

- A site plan that shows the original structure footprint and the site to which the structure has been or will be relocated. The relocation site must be landward of the area affected by projected erosion for 75 years or the life of the structure, whichever is greater. General rules of thumb for an adequate distance are 35 ft. (10 m) from the predicted receded natural boundary or receded bluff/bank edge for low to moderately eroding sites, and 70 ft. (20 m) for rapidly eroding sites;

- To include climate change-induced sea level rise, determine what the projected SLR is for your area. For example, SLR of 0.5 m by 2050, 1.0 m by 2100 and 2.0 m by 2200 is predicted for most of the BC coast (Ausenco Sandwell, 2011 – see “Resources” under credit 2.3). Determine how this will change the location of the natural boundary over 75 years or life of the structure (whichever is greater), and determine the relocation site accordingly.

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

The Shoreline Habitat includes:

- the subtidal zone (in marine environments) or the littoral zone (in lake environments) to a depth of 35 feet (10 m) below datum;
- the foreshore or intertidal zone; and
- the riparian and backshore up to 60 m from the natural boundary.

Riparian Vegetation

Goal: Maintain or replant native riparian vegetation to conserve or enhance its value and the ecological functions it provides along the shoreline.

Riparian areas where land and water converge are among the most biodiverse of any habitats. Riparian vegetation is native vegetation that exists or is planted on the landward side of the natural boundary extending up to 200 feet (60 m) landward, and includes trees, shrubs, and ground cover.

Native vegetation is preferred for shorelines because native species:

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

However, mature non-invasive or “native adapted” plant species may be maintained if they provide some ecological functions.

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

Photo 6 (credit: The Watershed Company)

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

**Environmental Benefits:** Protection or re-establishment of riparian vegetation provides key ecological features, functions, and values of shoreline habitats and maintains the high biodiversity of riparian areas. Riparian vegetation:

- provides water quality and quantity benefits by enhancing the infiltration and retention of rainwater;
- delivers large woody debris (LWD) and food sources such as insects and detritus for the aquatic food web;
- moderates temperature in the riparian area for climate-sensitive plant and wildlife species, as well as in the beach substrate where forage fish spawn;
- on shallow slopes, can help to dissipate wave energy, thus moderating erosion and supporting the accumulation of beach sediment; and
- the roots of riparian vegetation provide shoreline bank integrity. Complex networks of branches, trunks, stems, and roots along the shoreline provide habitat for birds and terrestrial animals, and cover for juvenile salmonids to avoid predation by birds.
How to Accomplish

Choose native species that are suitable to your site. As much as possible, planting should be comprised of multistoried vegetation that includes trees, shrubs and ground cover, but in some cases (e.g., south facing rocky bluffs with thin, dry soils on rock), only shrubs, grasses and other ground cover may be suitable. While mature non-invasive or “native adapted” plant species can be maintained as they provide some ecological functions, avoid planting new non-native species.

Planting may be ‘averaged’ in the 11 m riparian buffer to a limited extent – meaning that the riparian area may be thinner than 11 metres in some portions by +1.5 metres and wider in others as long as the overall average is 11 metres.

Space plants to achieve a minimum 65% native vegetation coverage within 10 years. Space trees at 2.4 – 4.3 metres on center and shrubs at 0.6 – 1.8 metres on center depending on the plant species. You may need some assistance from a landscape architect, restoration biologist or landscaper with riparian planting experience to determine the best species and spacing to achieve the desired effect.

Invasive Species

Goal: Remove, reduce and manage invasive vegetation and noxious weeds.

This recognizes efforts to remove invasive or noxious vegetation and re-plant with native vegetation. Check the “Resources Section (pg. 42) – Invasive Species” for more detailed inventories and information on invasive/noxious species and their management.

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

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

- Provides better aesthetics, noise reduction, and increased privacy once the planted areas have matured – all of which increase property values;
- Prevents damage to other vegetation you wish to maintain;
- Results in lower maintenance landscapes; and
- Creates greater wildlife watching opportunities.
Environmental Benefits: In addition to those benefits associated with maintaining and restoring native vegetation described in the Riparian Vegetation credit above, this credit is intended to restore natural ecological functions. In general, removing invasive vegetation:

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

How to Accomplish

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

Include invasive species management as part of the regular landscape maintenance schedule or checklist (see Credit 4.6 and Appendix B). Monitor your property for several years for signs of returning invasive vegetation and/or noxious weeds, and plan to remove them as needed. Remember that it is much easier to remove these species as they emerge rather than once they are established. Again, a qualified professional, your local government or local environmental group can advise on effective but environmentally-friendly ways to manage particularly tenacious species. Suggest that your neighbors share in work parties to help each other, or suggest the same to your Homeowners or Neighborhood Association.
Wildlife Trees (Snags)

**Goal:** Retain existing dead trees on site as wildlife trees (snags). If the dead tree is a hazard to life or property, remove the hazard-causing portions rather than removing the trees completely.

**Homeowner Benefits:** Wildlife trees create interesting landscape features while providing increased wildlife viewing opportunities

**Environmental Benefits:** Dead trees (snags) provide valuable feeding, nesting and burrowing habitat for birds and small mammals.

**How to Accomplish**

Evaluate existing dead trees on the site for their potential as wildlife trees. Generally, the value of a snag tree increases as its size increases. Large snags (greater than 38 cm diameter at chest height and taller than 1.8 m) are required for larger species such as certain woodpeckers; smaller birds and animals may use snags or dead limbs from 10 cm in diameter.

Animals may have a preference for snags of certain tree species, and these tree species preferences may vary from region to region. Hence, the species of snags retained should reflect the native trees found in the area.

Landowners may need to consult a professional when determining if a snag presents a substantial hazard, particularly given the relative location of the snag to existing or proposed infrastructure/development. If removal must occur, remove only unwanted portions of the trees; this allows the remaining portions to provide valuable wildlife habitat. Trees and snags are part of functional riparian vegetation.
Large Woody Debris

**Goal:** Retain large woody debris (LWD) where it naturally occurs.

LWD includes trees and large branches that fall naturally along a shoreline across the beach or into the water, and logs and stumps that wash up onto a beach.

**Homeowner Benefits:** Stumps and logs anchor and stabilize beach sediments and beach grasses, providing natural shoreline protection.

**Environmental Benefits:** LWD is a vital component of healthy shoreline ecosystems. It creates habitat cover and complexity; helps to accrete and sort sediments, creating spawning habitat for forage fish; stabilizes banks and shorelines; supports the growth of native beach grass, which also helps to stabilize shorelines; protects dune communities, thereby supporting the next generation of forests; and is a source of organic matter and food for aquatic insects, invertebrates and the organisms that feed on them.

**How to Accomplish**

Identify and map existing LWD pieces as part of your pre-design site assessment in order to integrate them in the site design plan. Removal of a portion of the existing LWD is appropriate if needed to provide room for your project (such as for an over-water structure), or for hazard control (the LWD may ram an existing structure if floated by high water). Temporarily moving, saving and re-installing natural LWD as needed to facilitate the project should be considered; check with local authorities if there are any regulatory requirements to do this, particularly when large pieces are involved.

If required, consult with a qualified professional such as a coastal engineer or engineering geologist before re-introducing LWD to determine the most effective placement and to avoid creating hazards. Include locally recruited (downed trees) and driftwood in the overall plan for LWD. Try to match ‘historic ‘conditions when adding LWD.

Avoid artificially anchoring LWD. It can be placed semi buried, particularly if it is placed as part of a “soft shore”, beach nourishment project or loosely on the upper and back beach areas, in wetlands, and along the shoreline of lakes. Anchor LWD by mechanical means only when recommended by a qualified professional and with approval by local authorities.
Overwater Structures

**Goal:** Do not install new overwater structures at a project site; remove any existing overwater structures. If overwater structures are necessary, design them to be Green Shores friendly.

Overwater structures are piers, ramps, floats, buildings and associated pilings, covered moorage, boat work sheds, and mooring pilings. An overwater structure may include multiple elements such as a pier, ramp and float.

**Homeowner Benefits:** Having no overwater structures, or structures, can result in several benefits:
- Cost savings - no maintenance, or low maintenance of shore friendly structures; e.g., grated construction tends to be low maintenance and durable and provides ambient light beneath such structures.
- Green Shore designs and construction methods are usually consistent with local regulations, and therefore, the permitting process may be easier, shorter and less costly (e.g., detailed biological assessments and habitat mitigation may be avoided).
- Better natural aesthetics.

**Environmental Benefits:**
- Prevents the loss of nearshore ecological functions such as underwater natural ambient light and habitat area.
- Minimizes the effects of overwater structures on underwater plant communities;
- Minimize disruption of fish movement and migration; and
- Decreases potential predation on juvenile salmon by reducing habitat for predators.

**How to Accomplish**

Owners are encouraged to use mooring buoys, if local zoning permits, if boat moorage is needed.
provided that there is no impact on seafloor ecosystem/habitat, use a public dock if one is nearby, or share an existing dock with neighbours. To minimize impacts on shoreline habitat and processes, adhere to the following ‘best practices’ in the design, construction, maintenance and repair of overwater structures:

- Assess the nearshore and benthic habitat before starting to plan, so that the structure is located where no critical/sensitive habitat exists.
- Minimize size – e.g., minimize the width and length of piers and floats.
- Minimize disturbance of the bottom – e.g., minimize number and size of piles.
- Use nontoxic materials
- Minimize shading by orienting a structure in a north-south direction and positioning it a minimum of 7 ft. (2.3 m) above benthic vegetation.
- Maximize natural light penetration – use grating or gridding.
- Minimize overwater lighting.
- Design structures to be retractable when not in use (e.g., for the winter season).
- This should be achieved in conjunction with any local bylaws that require specific siting or size requirements of docks or floats.

**Access Design**

**Goal:** Design or re-design access to the shoreline from upland areas so that it avoids or minimizes environmental impacts on the shoreline area.

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

**Homeowner Benefits:** Controlled access usually means lower construction and maintenance costs, and enhances the aesthetics and value of the property.

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

**How to Accomplish**

First ask “do I really need my own access to the shore? Is there a public access nearby that I can use, or could I a share an existing access with one or more neighbours?”
If the answer is “no, I don’t need my own access” – you have saved the shoreline environment one more impact, and saved construction, approval and maintenance costs and time.

If the answer is “yes”:

- Assess the shoreline and backshore to determine the best place for getting to the water based on steepness, ground stability, soil softness, vegetation, drainage, environmental sensitivity and habitat value. A rocky site is usually harder than sites with soft sediments. Choose sites that have been previously impacted since they have lower habitat value than an undisturbed site. Do your utmost to protect undisturbed areas.
- Provide for all needs in one access rather than multiple accesses.
- Size and align paths and stairways to address terrain (flat versus steep), to protect existing vegetation (particularly major trees, shrubs and rare plant groupings) and avoid hazardous areas such as ravines, cliffs and embankments.
- Use permeable, non-toxic materials for the access surface. For lightly used paths, native soils may be adequate. For heavier use or where drainage is an issue, crushed aggregate (gravel) with a lightly compacted aggregate sub-base is preferred. Bark mulch or hog fuel are not recommended as trail surfaces because they produce leachates that can cause water quality problems. Asphalt and concrete are also not recommended as they leach contaminants in the short term, and are impermeable and accelerate run-off in the long run. If solid surfaces are necessary, install pervious pavers.
- Use raised permeable walkways whenever possible to avoid crushing ground cover.

Water Quality

Runoff & Pollutant Management

This encompasses actions that a shoreline landowner can take to reduce or eliminate the amount of sediment, chemical and organic pollutants that are discharged to lakes and marine waters as rainwater runoff. The runoff associated with rain events is typically referred to as “stormwater”, but it is important to recognize that the majority of surface runoff is from light, steady rainfall and not just occasional storms. Therefore, in this section, we use the term “rainfall runoff” in addition to “stormwater” to refer to the accumulated runoff from regular rainfalls as well as bigger storms.

Site Disturbance

Goal: Minimize the amount of clearing, grading and soil disturbance on the site.
It is particularly important for projects on sloping sites, sites with runoff from upland areas, sites with highly erodible materials, and bluff properties where slope failure risk is high.

**Homeowner Benefits:** Minimizing site disturbance benefits home owners by:

- reducing the risk of soil erosion and the cost of erosion control measures during and after construction.
- retaining valuable topsoil, which means less cost to buy and truck in expensive topsoil to rebuild landscapes.
- reducing future landscape installation costs.
- reducing irrigation costs; existing native vegetation is often better suited to site conditions and typically do not require additional irrigation.
- maintaining the intrinsic value of native trees and shrubs.
- maintaining shade and wind breaks that can save on cooling and heating costs.

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

Minimizing soil disturbance and compaction also:

- helps to retain soil structure and pore space that allows movement of water and air; healthy native soils with good structure are more permeable than newly imported growing medium, and can help reduce surface water runoff.
- retains beneficial biological components - worms, micro-organisms, and roots in existing soils.
- avoids trucking of stripped material off site or bringing soil on-site, lowering costs and reducing greenhouse gas emissions.
- avoids the release of greenhouse gases from organic soils when they are disturbed.

**How to Accomplish**

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

- Locate buildings and hardscape surfaces on previously impacted areas of the site such as clearings, existing building footprints, or on areas that were going to be cleared anyway (i.e. to remove invasive species such as Himalayan blackberry).
Minimize the amount of excavation and earthworks needed by fitting the building or landscape design to the site topography rather than flatten the site to fit the building or landscape.

During construction, protect vegetation and native soil areas from soil disturbance and compaction by surrounding them with a secure 4’ fence of high visibility material.

Restrict construction vehicle traffic to designated driveways/accesses to reduce damage to soils and vegetation. On small sites, this may mean parking off-site on a nearby road edge. Encourage carpooling.

Designate specific staging areas for materials (gravel, lumber, etc.) in previously disturbed areas.

During construction, protect vegetation and native soil areas from soil disturbance and compaction by surrounding them with a secure 4’ fence of high visibility material.

To restore disturbed areas, you can enhance soils and replant vegetation using the following measures:

- Cultivate compacted soils to a depth of 300 mm and till 15 cm of compost into the soil; and,
- Plant green manures (e.g. clover, alfalfa, fall rye, etc.) to improve soil structure, porosity and fertility; till these crops into the soil 3-4 weeks before planting with desired vegetation.
- Plant native vegetation primarily in the fall to reduce watering requirements.
- Manage invasive species before they take hold.

Development practices can increase groundwater and saturate bluff soils, increasing the likelihood of slope failure.
Conservation Covenants

**Goal:** Establish a conservation covenant or easement on a shoreline property, or a portion thereof, that protects natural features of the shoreline.

A conservation covenant is a voluntary, legally binding agreement between a landowner and a covenant holder in which the landowner promises to steward the land in ways that are specified in the covenant. A covenant holder may be a government or a non-government organization that is recognized under applicable federal, provincial legislation as being able to hold covenants - such as a land trust or nature conservancy. The covenant holder enforces the provisions of the covenant/easement if the owner does not abide by its terms. A special attribute of a conservation covenant is that it is registered on the title of the property, ensuring that it binds all current and future owners of the land. In this way, the protection that the covenant bestows is permanent and “runs with the land”. A land owner may establish a conservation covenant on all or a portion of their property at any time if they and a covenant holder agree that the ecological values of that property should be preserved.

**Homeowner Benefits:** Conservation covenants may be of interest to landowners who wish to preserve the ecological values of their properties regardless of who may own it in the future. In some jurisdictions, a conservation covenant may make the property eligible for reduced property taxes; e.g., the Natural Area Protection Tax Exemption Program in the Islands Trust Area in BC. See the “Resources” section below for details.

Conservation covenants on ecologically sensitive lands may also qualify as “ecological gifts” under the federal *Income Tax Act*, and be eligible for income tax credits (deductions from taxable income). The value of the covenant, as determined by a qualified appraiser, equals the difference between the fair market value of the property before and after the covenant takes effect.

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

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

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

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

- Contact the Islands Trust Fund (http://www.islandstrustfund.bc.ca/) to see if what you are proposing is applicable.
- Identify the land (the entire property or portion thereof) to be protected under the covenant.
- Identify the characteristics of the land that are to be permanently protected – special natural features, important habitats, etc.
- Obtain legal and tax advice.
- Conduct an environmental assessment of the property to ensure it fits within the conservation objectives of the conservation organization and to disclose any outstanding liabilities connected with the land (e.g., existing liens on the property, environmental contamination).
- Negotiate the terms and conditions of the conservation covenant/easement. Examples of Green Shores-based provisions might include:
  - Permanently maintain a shoreline riparian buffer - width and length to be defined, as well as acceptable and unacceptable activities in the buffer.
− No shoreline structures (e.g., seawalls, seawalls, piers, docks, etc.) to be constructed except in accordance with the covenant.
− No subdivision of the property except in accordance with the covenant.
− Preserve specific shoreline features present on the property – e.g., a bluff ecosystem, trees, etc.
− Preserve rain gardens on the property that manage site drainage so as to minimize impacts on the shore.
− No impervious surfaces to be constructed.

• Have a survey and/or appraisal completed, if necessary.
• Prepare a management plan and management agreement, where necessary.
• Prepare the conservation covenant document.
• Execute the covenant and register it on title.
• Over the long term, monitor the land as agreed in the conservation covenant.
GLOSSARY OF TERMS

**Backshore** – land above the natural boundary.

**Drift cell** – the nearshore area that includes a sediment source, a transport zone and a deposition zone. Drift cells repeat along the shore, sometimes with smaller cells nesting in larger cells.

**Eroding or Feeder bluff** – bluff usually composed of glacial sediment that serves as sediment source for beaches in a drift cell.

**Foreshore** – the area between high tide (or natural boundary) and low tide water levels in marine systems, or between seasonal high water and low water levels on lakes.

**Intertidal zone** – in marine systems, the area between high tide and low tide levels.

**Littoral zone** – a general term referring to the part of a sea or lake that is close to the shore.

**Littoral, longshore or net shore drift** are 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.

**Natural boundary** is defined as “the visible high water mark of any lake, stream, or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river stream, or other body of water a character distinct from that of the banks, both in vegetation and in the nature of the soil itself” (BC *Land Act*). This is also commonly referred to as the Ordinary High Water Mark (OHWM).

**Nearshore** – another general term that encompasses the riparian, intertidal (foreshore) and subtidal zones.

**Riparian zone** – the land immediately above the natural boundary that acts as an interface between water and land; usually described as a certain width (e.g. 10 m; 15 m; etc.) of land measured perpendicular to the shoreline.

**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.
Diagram 4: Lake Shoreline Description

Diagram 5: Ordinary high water mark (OHWM) and other parts of the shore – lake example (Fisheries and Oceans, Canada)
Ocean Shoreline Description:

Diagram 6: Shoreline Description
Diagram 6: Example of Drift Cell – Goose Spit near Comox BC:

Diagram 7: Drift Cell
Diagram 8: Shoreline Processes

Figure 3: Littoral or longshore drift
This diagram shows a typical littoral drift cell extending from the eroding bluff at the bottom to the spit at the top. The eroding bluffs are interrupted by a stream mouth and a short segment of barrier beach. The solid arrow shows the direction of net longshore transport, or drift, of sediment. The dashed line denotes a reach where the orientation of the shoreline allows transport to be in either direction, thereby sharing the sediment with the neighboring cell. (from Shipman, 2008; p.11)
RESOURCES

Islands Trust Website: http://www.islandstrust.bc.ca/


Environmental Management Plan

- Erosion Prevention & Sediment Control, Capital Regional District, Victoria, BC
  - [http://www.crd.bc.ca/watersheds/lid/erosion.htm](http://www.crd.bc.ca/watersheds/lid/erosion.htm)
- Best Management Practices for Erosion and Sediment Control, City of Vancouver, BC
  - [http://www.metrovancouver.org/about/publications/Publications/BMPVol2b.pdf](http://www.metrovancouver.org/about/publications/Publications/BMPVol2b.pdf)
- Erosion and Sediment Control Brochure, City of Nanaimo, BC
  - [https://www.nanaimo.ca/assets/Departments/Building~Inspection/Publications~and~Forms/erosion.pdf](https://www.nanaimo.ca/assets/Departments/Building~Inspection/Publications~and~Forms/erosion.pdf)

Critical or Sensitive Habitats

- Species at Risk and Local Government: a primer for BC [http://www.speciesatrisk.bc.ca/](http://www.speciesatrisk.bc.ca/)

Setback/Impact Avoidance

  [http://www.env.gov.bc.ca/cas/adaptation/sea_level.html](http://www.env.gov.bc.ca/cas/adaptation/sea_level.html)

**Shoreline Habitats**


• Naturescape British Columbia. www.naturescapebc.ca

**Invasive Species**


• http://www.invasiveplants.net/ Cornell University Ecology and Management of Invasive Plants Program:


**Overwater Structures**


**Access Design**


**Water Quality**


**Stormwater Runoff Control**


• Capital Regional District, Victoria, BC - links to LID examples and stormwater management BMP examples in the Capital Region [http://www.crd.bc.ca/watersheds/lid/index.htm](http://www.crd.bc.ca/watersheds/lid/index.htm)


**Rainwater Management**


**Environmentally Friendly Building**


• Department of Fisheries and Oceans Canada. *Guidelines to Protect Fish and Fish Habitat From Treated Wood Used in Aquatic Environments in the Pacific Region.* [http://www.dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca)


**Treated Wood**

• Department of Fisheries and Oceans Canada. *Guidelines to Protect Fish and Fish Habitat From Treated Wood Used in Aquatic Environments in the Pacific Region.* [http://www.dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca)

**Integrated Pest Management**


**On-site Sewage Treatment**

• BC Sewerage System Standard Practice Manual
  [www.health.gov.bc.ca/protect/lup_standards.html](http://www.health.gov.bc.ca/protect/lup_standards.html)
• Capital Regional District – septic systems guidance and bylaw
  [www.crd.bc.ca/wastewater/septic/index.htm](http://www.crd.bc.ca/wastewater/septic/index.htm)
• Regional District of Nanaimo “SepticSmart” program -
  [www.rdn.bc.ca/cms.asp?wpID=1159](http://www.rdn.bc.ca/cms.asp?wpID=1159)
• The Living by Water Project – Septic Systems [www.livingbywater.ca/septic.html](http://www.livingbywater.ca/septic.html)

Conservation Covenants

• Land Trust Alliance of BC. *Conservation Options: How you can leave a legacy for the future*. [www.ltabc.ca](http://www.ltabc.ca)
• Islands Trust Fund, Natural Area Protection Tax Exemption Program -
  [http://www.islandstrustfund.bc.ca/naptep.cfm](http://www.islandstrustfund.bc.ca/naptep.cfm)