ATTACHMENT F

# Soft Shoreline Stabilization

Shoreline Master Program Planning and Implementation Guidance

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# Soft Shoreline Stabilization

## Shoreline Master Program Planning and Implementation Guidance

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# Executive Summary

**Purpose, Scope, and Need**

The purpose of this guidance is to assist local government planners and permit staff in planning and implementing shoreline stabilization provisions within Shoreline Master Programs. This guidance provides an introduction to common shoreline stabilization impacts and applicable regulations. In addition, it describes the underlying intent of soft stabilization management policies and identifies key considerations for soft shoreline planning and permitting. It also describes some anticipated challenges related to soft shoreline stabilization projects.

The scope of this guidance is focused on soft shoreline stabilization management of marine shorelines in Puget Sound through Shoreline Master Program planning and administration. It does not describe or evaluate specific soft shoreline stabilization techniques or designs. While the standards and discussions apply to all types of shoreline development, many examples in this guidance are focused on single-family residences.

This guidance is primarily driven by local jurisdiction need to comprehensively update Shoreline Master Programs to reflect the 2003 Shoreline Master Program Guideline changes administered by the Washington Department of Ecology. Among these changes is an emphasis on a preference for soft shoreline stabilization over shoreline armoring, or hard stabilization. In an effort to succeed in achieving policy goals of the Shoreline Management Act and to support local governments administering Shoreline Master Program provisions, we developed guidance focused on the management of soft shoreline stabilization.

This guidance provides management recommendations specifically for Puget Sound soft stabilization scenarios. The Washington Department of Ecology is also developing a Stabilization Chapter for the Shoreline Master Program Handbook that will address the broader topic related to shoreline stabilization. Local jurisdictions can utilize this guidance along with the handbook chapter when facing challenges or discovering opportunities in implementing soft shoreline stabilization policies.

**Summary of Main Sections**

*Background*

Puget Sound's shoreline health is important to the citizens of Washington and hard stabilization can have negative impacts to shoreline health. Soft shoreline stabilization has been recognized as a way to minimize negative environmental impacts while still providing effective protection. The Shoreline Master Program Guidelines state a preference for soft stabilization over hard stabilization. Local governments are responsible for incorporating this preference within their updated Shoreline Master Programs and applying this preference through Shoreline Master Program administration.

*What is Soft Shoreline Stabilization?*

Soft shoreline stabilization is the use of environmentally friendly stabilization techniques used to protect property and uses from shoreline erosion. The management intent of soft shoreline

stabilization is to permit projects that balance the need for erosion protection while maintaining and enhancing shoreline ecological functions.

Shorelines stabilization can be illustrated on a continuum. Shorelines can range from natural, undisturbed shorelines with no structural stabilization features to shorelines completely hardened with artificial structures. Determining where a project falls on this continuum can be problematic due to a lack of a clear distinction between soft and hard projects. Soft stabilization projects contain key features that either maintain or enhance ecological functions. The number, extent, and appropriate use of these key features within stabilization projects will strongly influence whether or not they are considered soft.

*Planning for Soft Shoreline Stabilization*
Effective implementation of soft shoreline stabilization provisions will help local jurisdictions maintain consistency with the principle goal of the Shoreline Master Program Guidelines policy to ensure no net loss of ecological functions. Appropriate planning for soft shorelines will likely increase successful implementation and ensure that soft projects are occurring where they are feasible and necessary.

Jurisdictions can use Shoreline Master Program update resources to proactively plan for soft shorelines. This includes using information gathered for the Shoreline Inventory and Characterization Reports and utilizing the differing characteristics and management goals applied to Environment Designations. Jurisdictions are encouraged to set priorities for the types of soft stabilization features preferred or most consistent with the applicable Shoreline Master Program.

Local jurisdictions are encouraged to identify strategies for defining soft projects to assist reviewing stabilization proposals. Some jurisdictions set specific standards, clearly stating their expectations for particular soft designs, while other jurisdictions have chosen a more flexible approach utilizing criteria to evaluate projects on a case-by-case basis. Some jurisdictions with available resources have chosen to gather specific information related to shoreline stabilization in order to increase the success of soft stabilization. Local governments are encouraged to learn from one another's strategies and experiences to tailor individual plans and Shoreline Master Program implementation approaches.

*Permitting Soft Shoreline Stabilization*
It is critical that local jurisdictions apply the shoreline modification principles listed in the Shoreline Master Program Guidelines through administration of SMP provisions. Specific shoreline stabilization standards, such as demonstration of need, are also important to ensure appropriate evaluation of soft shoreline stabilization proposals. The regulatory evaluation of stabilization proposals must follow defined protocols to determine first that some form of stabilization is necessary, and then conclude that the proposed stabilization design is the softest method feasible.

The Shoreline Master Program Guidelines also suggest that jurisdictions apply different considerations between new and replacement soft stabilization projects. New soft stabilization projects on sites with no previous structural stabilization must first consider methods that avoid

ecological impacts prior to considering ways to minimize and mitigate impacts to ecological functions. Alternatively, soft stabilization proposals that are intended to replace hard stabilization should focus on opportunities for incremental improvement to ecological functions.

When reviewing soft stabilization permits, staff should consider whether or not a proposed project will meet the intent of soft stabilization. Reviewers can use questions related to physical and biological processes, habitat, intertidal considerations, and material and methods to evaluate if a project will maintain or enhance ecological functions.

*Anticipated Challenges to Implementing Soft Shoreline Stabilization*
There are a number of anticipated challenges to soft shoreline implementation outside the direct influence of Shoreline Master Programs. To mitigate these challenges, it is recommended that stakeholders be informed of the range of challenges and be involved in efforts to ensure successful implementation. Such challenges include those related to property owner behavior, financial cost, permitting complexity, historical situations, and industry knowledge. These challenges represent areas where future efforts can be directed to improve the likelihood of soft shoreline stabilization acceptance by stakeholders and ultimate success in managing this challenging issue.

*Conclusion*
Soft shoreline stabilization is a complex topic. Understanding the intent of soft shoreline policies is critical for planning and permitting soft designs. Considering the context of each shoreline site is important for determining the most appropriate soft stabilization features. These are important messages for effective application of Shoreline Master Program provisions.

Shoreline Master Programs are just one part of a bigger picture that includes technical design guidance, incentives, social marketing, and outreach. A multidisciplinary approach is needed to address the challenges related to soft stabilization and increase the likelihood of acceptance and success. The Washington Department of Ecology and local governments will continue to learn from Shoreline Master Program implementation and other efforts on how to best realize soft shorelines to benefit Washington's shorelines and the public.

# How to Use this Guidance

This guidance is intended to assist local government staff in understanding the soft shoreline stabilization concept, planning for soft stabilization, and implementing soft shoreline stabilization regulations through administration of updated Shoreline Master Programs. This guidance can be used as a research and information manual for a comprehensive understanding of soft shoreline stabilization, or as a quick reference manual for staff searching for specific topics.

This guidance can be used by local jurisdictions in variety of different stages, either as a part of their Shoreline Master Program update or through administration of the updated Shoreline Master Program. The planning section of this document can be used by local jurisdictions in the process of updating their Shoreline Master Programs. Jurisdictions in this stage may consider using some of the suggestions in this guidance to include specific information for analysis within their Shoreline Inventory and Characterization Reports, or to influence specific Shoreline Master Program language. Jurisdictions that have completed or are near completion of the Shoreline Master Program update can use the planning section suggestions to inform future information gathering efforts, formal administrative interpretations, amendments to the Shoreline Master Program, and the eight year review.

Jurisdictions implementing their updated Shoreline Master Programs can use the permitting section to assist in day to day Shoreline Master Program administration. This section may be particularly useful for jurisdictions that may not receive many shoreline stabilization permits on a regular basis, and therefore may benefit from a review of soft stabilization standards. Planners may also find the permitting section useful in requesting additional information from project proponents to appropriately address standards such as demonstration of need.

Local governments are encouraged to apply this guidance in whatever is most relevant to their needs. We hope that this information encourages individual jurisdictions to develop local implementation guides to assist staff in using the new regulations within their updated Shoreline Master Program. Local implementation guides can include the fundamental concepts and Shoreline Master Program Guideline standards presented in this document and further refine the content to adapt to local circumstances, specific codes, or policies of their Shoreline Master Program.

# Acronyms

| | |
|---|---|
| ACOE | Army Corps of Engineers |
| ECY | Washington Department of Ecology |
| EPA | Environmental Protection Agency |
| MHHW | Mean Higher High Water |
| OHWM | Ordinary High Water Mark |
| PSP | Puget Sound Partnership |
| RCW | Revised Code of Washington |
| SMA | Shoreline Management Act |
| SMP | Shoreline Master Program |
| WAC | Washington Administrative Code |
| WDFW | Washington Department of Fish and Wildlife |
| WDNR | Washington Department of Natural Resources |

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# Part I: Background

Sections included in Part I:

- Puget Sound and Shoreline Armoring
- Impacts of Shoreline Armoring
- SMA, SMP Guidelines, and Shoreline Stabilization
- The Need for Soft Shoreline Stabilization Guidance

## Puget Sound and Shoreline Armoring

Puget Sound is the second largest natural estuary in the United States. It is a region of great complexity and productivity. Puget Sound is an economic engine and important trade center for Washington, the Pacific Northwest, and the United States (Puget Sound Partnership, 2012). Puget Sound is also home to about 4.1 million people (Puget Sound Partnership, 2012) and is expected to reach 5.33 million by 2020 (Fresh et al. 2011). Population growth in the region is anticipated to increase demand for Puget Sound resources (Puget Sound Partnership, 2012), including shoreline property.

Plate tectonics, glaciations, sea level, tides, fetch-limited waves, rivers, and streams have created a dynamic Puget Sound Basin. The Puget Sound nearshore zone continues to be dynamic system subject to erosion, longshore drift, and accretion features (Shipman, 2010). The dynamic erosion features of Puget Sound shorelines are vital to nearshore health. However, development of the shoreline for commercial, recreational, and residential uses has led to armoring techniques to protect structures and uses from natural erosion processes. Approximately 27% of Puget Sound's shorelines are currently armored with some type of stabilization technique (Puget Sound Partnership, 2012).

Due to concerns about shoreline armoring impacts to the nearshore environment, the Puget Sound Partnership has developed the following Shoreline Armoring Target: More armoring removed than added during the time period of 2011-2020. In 2005-2010 there was a net gain of about 6 miles of armoring, despite armoring regulations and armoring removal restoration projects. There was also about 14.5 miles of replacement armoring. Single-family residences accounted for 76% of the new shoreline armoring length and 25% of armoring removal length (Puget Sound Partnership, 2012). Therefore, single family residences represent an opportunity to impact the PSP Shoreline Armoring Target and other environmental policy goals through new armoring prevention, armoring removal, and implementation of hard armoring alternatives such as soft shoreline stabilization.

# Impacts of Shoreline Armoring

Shoreline armoring, also referred to as shoreline stabilization or shoreline protection, can have negative impacts to nearshore physical and biological processes, habitat, and ecological functions. Specific shoreline and nearshore impacts from shoreline armoring will vary between armoring techniques and shoreline sites. The following is a list of potential impacts shoreline armoring may have at a particular shoreline site (Shipman, 2010):

- Loss of upper beach and backshore
    - Reduces area of dry beach at high tide
    - Reduces amount of accumulated large wood and beach wrack
    - Reduces forage fish spawning habitat
    - Reduces area available for recreation
- Modifies aquatic-terrestrial connectivity
    - Affects movement of materials and organics between aquatic and terrestrial systems
    - Reduces quality of riparian functions
    - Alters drainage patterns to the beach
- Passive erosion
    - Does not allow for the natural retreat of the shoreline, which narrows the remaining beach
- Alters sediment delivery and transport
    - Reduces the delivery of sediment into the system and reduces the overall budget of the local littoral cell
    - Impedes alongshore transport and causes localized erosion downdrift
- Altered wave action
    - Increases erosion and scour through wave reflection

The potential impacts shoreline armoring may have at a particular site will depend upon shoreline type, shoreline condition, and the shoreline armoring design. Therefore, one or several impacts may occur.

In response to the concern for Puget Sound nearshore health, many agencies and organizations are taking actions related to policy, regulation, funding, research, and education of shoreline armoring issues. For example: the Puget Sound Partnership has listed a Shoreline Armoring target within the 2012 Puget Sound Action Agenda; there is active research by Washington Sea Grant and others comparing Puget Sound shoreline armoring sites with unarmored sites for ecological impacts; and public workshops, such as the Sound Living event put on by the WSU Snohomish County Extension Beach Watchers, have included sessions on shoreline armoring and alternatives. Regulatory agencies are focusing on how to better implement regulations regarding shoreline armoring, particularly in light of the comprehensive updates to local Shoreline Master Programs mandated by state legislature.

## SMA, SMP Guidelines, and Shoreline Stabilization

The Shoreline Management Act of Washington State (SMA) was adopted by voters in 1972. It is intended *"... to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines"* [RCW 90.58.020] through establishment of a planning process to balance both utilization and protection of shoreline areas throughout the state. There are three main policies to the Shoreline Management Act:

- Establish preferred uses of the shoreline
- Environmental protection
- Public access

Under the SMA, each city and county with shorelines of the state (all marine waters, rivers with flow great than 20-cubic feet per second, and lakes larger than 20-acres in size) are required to prepare and adopt a local Shoreline Master Program (SMP). SMPs must be consistent with State SMP Guidelines. Many of the original SMPs were created between 1974 and 1978 in response to the State's enactment of the SMA. In 2003, in response to a directive from the state legislature, The Washington Department of Ecology (Ecology) updated the SMP Guidelines, which in turn requires more than 270 local jurisdictions to update their local SMPs.

Single-family residences are listed in the SMA as a "priority use" when developed *"... consistent with the control of pollution and prevention of damage to the natural environment"* [RCW 09.58.020]. Therefore, it is recognized that shoreline development for residences will continue into the future. Specific to managing shoreline stabilization associated with future residential uses on vacant lots, the SMP Guidelines require that the proposed development be sited in such a way that no shoreline stabilization will be needed for the lifetime of the structure. However, this standard is contrasted by allowance for new shoreline stabilization to protect existing residential structures due to unforeseen circumstances and a demonstrated need for stabilization when an imminent threat to the residence is documented.

Soft shore stabilization methods have been recognized as a strategy to address SMA policies by providing protection for a prioritized shoreline use, while also providing for environmental protection and enhancing public benefit. The 2003 WAC SMP Guidelines clearly state a general preference for soft, environmentally friendly shoreline protection measures when necessary for protection of existing residential structures [WAC 173-26-231 – Shoreline Modifications]. The SMP Guidelines provide a list of shoreline stabilization techniques generally described as soft to hard that serves as an example of the range of potential stabilization techniques [WAC 173-26-231 (3)(a)(ii)].

This guidance will focus on soft shoreline stabilization planning and implementation opportunities for single-family residences on Puget Sound shorelines. Guidance on statewide shoreline stabilization policies and regulations is in progress and will be available as a SMP Handbook chapter. For a further discussion and interpretation of the stabilization list provided in the SMP Guidelines as it relates to Puget Sound stabilization, see the Ecology webpage: http://www.ecy.wa.gov/programs/sea/shorelines/stabilization/index.html

# The Need for Soft Shoreline Stabilization Guidance

The requirement to update SMPs presents a challenge for local jurisdictions. They are required to comprehensively plan for appropriate shoreline management and effectively implement these plans over an 8 to 20 year timeframe. Shoreline stabilization is an important yet difficult part of both planning and implementation. The stabilization policies and regulations presented in the SMP Guidelines are fairly prescriptive (meaning the Guidelines do not leave a lot of room for local discretion) with regards to shoreline stabilization preferences and regulatory procedures required as part of SMP updates. However, implementing these standards within local jurisdictions is and will continue to be a challenge due to the complexities, uncertainties, and evolving perspectives surrounding the definition and application of soft shoreline stabilization.

This guidance attempts to further develop the concept of soft shoreline stabilization and provide potential strategies for planning and implementing soft shorelines through administration of local SMPs. Understanding the intent and concept of soft shorelines is equally important for regulatory and non-regulatory actions. A common understanding of soft shorelines between and among state and local agencies and organizations is also important; therefore this guidance, while written mainly from the Ecology perspective, has been reviewed by representatives from the Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR), and Army Corps of Engineers (ACOE).

Local SMPs are but one tool to address soft stabilization options, yet they are anticipated to be an important part of successful soft shoreline implementation within the region. Part of Ecology's role under the SMA is to support locals in the implementation of their SMPs. Therefore, Ecology felt it prudent to provide guidance to assist local jurisdictions in understanding the intent of soft shore stabilization within the SMP Guidelines, and in planning for and implementing soft alternatives.

# Part II: What is Soft Shoreline Stabilization?

Sections included in Part II:

- Alternative Terms
- Green Shorelines Concept
- Intent of Soft Shoreline Stabilization
- Shoreline Stabilization Continuum
- Attributes of Soft Shoreline Stabilization
- What is NOT Soft Shoreline Stabilization

Soft shoreline stabilization encompasses a wide range of stabilization techniques, environmental considerations, technical constraints, and performance expectations which can change from shoreline to shoreline. Soft stabilization techniques incorporate natural materials in a design that minimizes impacts to natural processes. In contrast, hard armoring techniques use hard materials such as large rock, concrete, or steel in designs that alter the shoreline configuration and severely limit natural processes.

The precise distinction between soft and hard stabilization projects is often unclear. There is, however, information that can be used to frame the intent of soft shoreline stabilization. Understanding the intent of soft shoreline stabilization is important for effective shoreline management.

This section of the guidance aims to describe the general intent of soft shoreline stabilization through explanations of broader shoreline health factors, similar technical terms, management intent, and how it relates to other possible shoreline conditions. Attributes that may contribute to what makes a stabilization project 'soft' are described and a description of what should not be considered soft shoreline stabilization is included to further clarify the soft stabilization concept.

## Alternative Terms

There are many terms used within Puget Sound and around the country that are generally synonymous with soft shoreline stabilization. However, each alternative term has a different history of use and definition. Each term is also used differently by various stakeholders, which has led to some confusion and overlap between the terms. Common terms used to refer to alternatives to hard stabilization techniques include:

- Soft Shore Stabilization
- Alternative Shoreline Stabilization
- Bioengineering
- Living Shorelines

- Green Shorelines
- Environmentally Friendly Stabilization

Stakeholders choose to use the various terms based on audience, message, history, and other factors. This guidance uses the term "soft shoreline stabilization" because it is terminology used within the SMP Guidelines and most accurately addresses the audience and scope of this guidance. Throughout this document, soft shoreline stabilization may be referred to generally as soft shorelines, soft stabilization, or soft.

# Green Shorelines Concept

In order to clarify the use of the term soft shoreline stabilization within this guidance, a discussion of a broader concept, termed Green Shorelines, is provided in this section. A brief introduction to the Green Shorelines concept is important to understanding the context and intent of soft shoreline stabilization.

Green Shorelines is a term that has been used in Puget Sound, particularly in the urban areas of Lakes Washington and Sammamish where workshops with stakeholders, social research, and other efforts have helped to define the concept. Green Shorelines is used to describe the concept of using natural materials and techniques to support sustainable coastal development or redevelopment in a manner that enhances or restores targeted ecological functions. The Green Shorelines concept applies to management of the entire shoreline property, not just what occurs directly along the water's edge. This includes lawn care, driveways, buildings, etc. The goal of Green Shorelines is to balance shoreline use with nearshore health. Green Shorelines can involve multiple strategies ranging from aesthetics, to water-quality, to habitat enhancements. Examples of Green Shorelines techniques include, but are not limited to:

- Retention or reestablishment of shoreline buffers to reduce water pollution and enhance shoreline habitat.
- Low-impact development that retains local soils and vegetation, minimizes building footprints, and reduces stormwater.
- Substitution or replacement of a hard concrete bulkhead with a softer bioengineered solution to re-create aquatic habitat lost to past development actions.

Independent of the progress in Lakes Washington and Sammamish, Green Shorelines remains an evolving concept in terms of how it is applied to a variety of different shoreline environments.

Soft alternatives to hard stabilization are one part of the broader Green Shorelines concept. In this guidance, soft shoreline stabilization refers to environmentally friendly structural stabilization techniques used to protect property from shoreline erosion. Soft shoreline stabilization, for the purposes of this guidance, does *not* include some Green Shorelines techniques such as buffer enhancements, stormwater control, pesticide use avoidance, or other environmental enhancement actions that take place away from the immediate shoreline edge and do not specifically address erosion issues. Soft shoreline stabilization in this guidance also does not generally include non-structural erosion protection techniques such as setbacks, buffers, and

relocation. While these techniques are important for management strategies supporting Puget Sound nearshore health, they are beyond the scope of this guidance.

## Intent of Soft Shoreline Stabilization

Rather than provide definitions for specific techniques and designs for soft shorelines, this guidance focuses on a description of the *intent* of soft shoreline stabilization policies. Understanding the intent of soft shoreline stabilization is critical to understanding how it can be used in shoreline management. This may lead to shoreline management decisions that recognize and adapt to site or reach level constraints, such as erosion and existing development, and opportunities to enhance nearshore function. The management goal of soft stabilization balances the important ecological functions natural shorelines provide to nearshore habitat and the need to protect existing primary structures and uses from erosion. Therefore, the intent of soft shoreline stabilization may be stated as follows:

**Soft shoreline stabilization projects balance the need to control erosion while also maintaining and enhancing shoreline ecological functions.**

It is important to recognize that the statement regarding maintaining and enhancing shoreline ecological functions applies to different contexts based on existing shoreline conditions. For example, new soft stabilization should focus on maintaining ecological functions to the maximum extent possible. One the other hand, replacement of hard stabilization with soft stabilization should focus on enhancing ecological functions. For a further discussion of the differences between new and replacement soft stabilization, please see the New vs. Replacement Stabilization section.

Another important consideration is technique vs. intent. Soft techniques (e.g. beach nourishment, large wood, etc) are important for the success of a project. However, it is how these techniques are used within the project design to achieve the overall management policy intent to maintain or enhance shoreline ecological function that make a stabilization project soft.

## Shoreline Stabilization Continuum

There is an array of shoreline stabilization possibilities ranging from natural, undisturbed shorelines with no stabilization features to heavily armored shorelines with little to no resemblance to the original shoreline. Soft shoreline stabilization lies between natural and hard armored shoreline conditions. However, structural and natural elements can vary considerably between soft stabilization projects. This can make shoreline stabilization projects difficult to definitively categorize as soft or hard. Use of the term hybrid stabilization can help describe the distinction between soft and hard, although it is also difficult to clearly distinguish a hybrid project for similar reasons.

Figure 1 is a visual representation of the shoreline stabilization continuum. Brief narrative descriptions are given below to help clarify the four categories along the continuum in Figure 1: Natural, Soft, Hybrid, and Hard. The main objective to considering stabilization projects on a

continuum rather than in discrete categories is to understand that there are no clear-cut definitions that separate these categories. Additionally, environmental impacts and benefits will vary within the soft category range.

**Natural Shoreline:** A purely natural shoreline is one which has not been modified by stabilization structures, fill, or significant vegetation removal. A restored natural shoreline can include the removal of shoreline modifications and enhancement of natural features without the use of structural materials. These shorelines best reflect the natural processes and functions and are important to nearshore health. A key point to remember is that while natural shorelines can be considered 'soft', soft shoreline stabilization is not natural, nor considered to be pure restoration.

**Soft Shoreline Stabilization:** A shoreline that has been stabilized with use of soft techniques utilizing no or minimal use of artificial structural elements is a soft shoreline. Soft stabilization is preferred over hybrid and hard structures. This is particularly relevant in shoreline reaches with little shoreline armoring, a high concentration of priority resources, and/or where soft techniques are likely to be successful at stabilizing the shoreline. Soft shoreline stabilization will provide ecological benefits over hybrid and hard structures but will generally have some short or long-term environmental impacts. For examples of soft stabilization projects, please see Appendix A.

**Hybrid Stabilization:** A hybrid approach to stabilization incorporates more artificial structural elements than soft stabilization techniques. Hybrid structures have more environmental impact to shorelines than soft shorelines and natural, undisturbed shorelines, but may contribute some ecological benefits over hard structures. Hybrid structures are encouraged over hard structures, and are typically relevant in shoreline reaches with significant hard shoreline armoring. They are also relevant in environments where soft shoreline stabilization is unlikely to be successful.

**Hard Shoreline Stabilization:** Hard shoreline stabilization is a technique that hardens and stabilizes the shoreline landward of the structure. Hard structures are static, employ a variety of structural elements and artificial materials, and may have significant environmental impacts to shoreline ecological processes and functions (Thom et al. 1994). Hard structures will have little environmental benefit compared to hybrid structures, soft shoreline stabilization, and natural shorelines.

Where a particular stabilization project falls upon the continuum will depend upon the extent the project maintains or enhances physical and biological processes and habitat existing at a site (see Evaluating Soft Shoreline Stabilization Proposals). Because of the unique characteristics of each shoreline site, the same soft stabilization technique will not necessarily be appropriate at every site. Therefore, the same stabilization technique may result as a soft project in one location and a hybrid project in another location, depending upon the ability of the project to meet ecological process, function, and habitat priorities. Jurisdictions are encouraged to consider this when planning and permitting for soft shoreline stabilization.

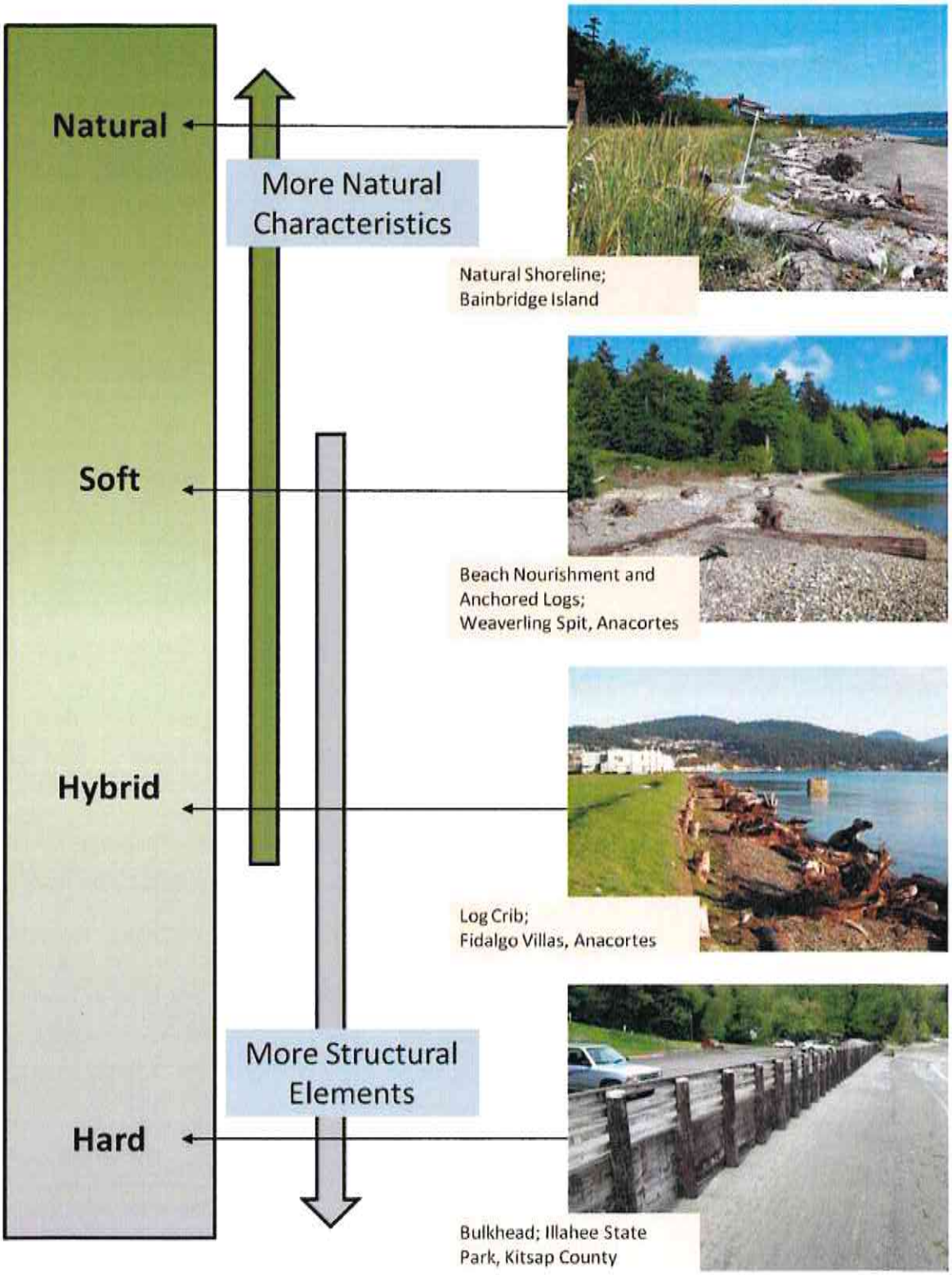


**Figure 1: Shoreline stabilization continuum**
(Hugh Shipman photos.)

# Attributes of Soft Shoreline Stabilization Projects

While there is no precise definition for what qualifies as a soft shoreline stabilization project, there are generally preferred features or "attributes" of soft projects. The identification of soft attributes can help distinguish the differences between hard and soft shoreline stabilization projects. The following is a list of general soft shoreline attributes:

- **Low gradients-**
  Hard armoring structures such as bulkheads, seawalls, and riprap tend to steepen the slope between aquatic and terrestrial habitats (Figure 2). This can reduce the area of intertidal and backshore habitat. Softer methods attempt to maintain gentler, more natural gradients.

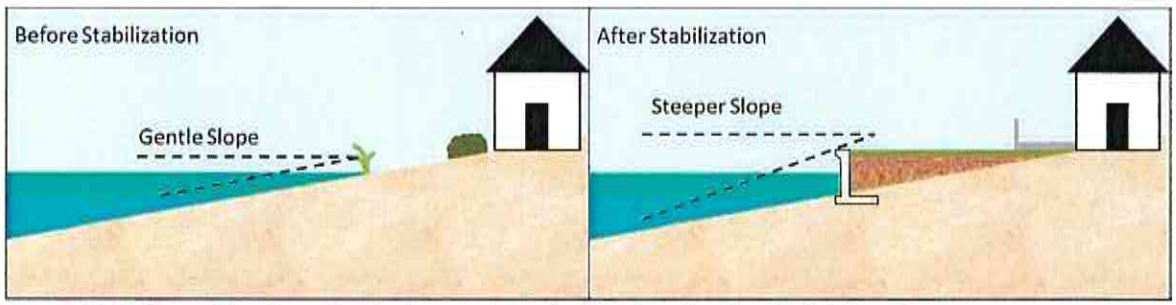


**Figure 2: Schematic of gradient change from before to after hard stabilization.**

- **Soft substrates-**
  Soft materials, such as sand, gravel, and mud, are the materials that tend to erode off of shorelines. Conventional armoring, because it employs hard structure and large rock, displaces or buries fine-grained sand and gravel habitats. This can result in an overall hardening of the shoreline. Soft shorelines tend to employ finer-grained, often more natural substrates, such as sand and gravel. Soft shoreline designs can either import these natural materials, or simply allow them to continue to erode, albeit at a slower pace.

- **Similar to naturally occurring geomorphic and ecologic settings-**
  Hard armoring typically changes the look, functionality, and habitat of shorelines. Soft shoreline stabilization projects employ strategies and materials that are more similar to the original, naturally occurring shorelines and surrounding shorelines.

- **Geologic and biologic connectivity with adjacent areas-**
  The connectivity between the aquatic and terrestrial environments is an important feature of natural shorelines. Examples include sediment eroding onto the beach from upland bluffs, overhanging vegetation, large woody debris, detritus, water, and shade (Brennan & Culverwell, 2004; Johannessen & MacLennan, 2007). Hard armoring techniques can result in a disconnection between the aquatic and terrestrial environment by limiting the exchange of materials such as nutrients and sediment (Thom et al. 1994). Soft shoreline

projects tend to maintain or enhance the connectivity between aquatic and terrestrial habitats.

The connectivity between adjacent beaches is also an important feature of natural shorelines. Feeder bluffs and other sources provide sediment to adjacent and down drift beaches (Johannessen & MacLennan, 2007), and other materials are also transported along the shoreline by waves and currents. Alongshore drift also transports large wood and other materials important for habitat to adjacent shorelines. Some hard armoring methods can inhibit the normal movement of sediment and other materials along shorelines. Soft projects tend to use methods that enhance or maintain the alongshore geologic and biologic connectivity of shorelines.

- **Dynamic and Flexible-**
  Natural shorelines are dynamic, shifting in response to storms and changing conditions. Natural erosion and accretion are ways beaches accommodate both chronic and acute/short-term change. Hard armoring is a static solution by design and does not allow for this natural flexibility provided by the movement of sediment (Johannessen & MacLennan, 2007; Shipman, 2010). Soft shorelines use materials and methods that maintain or enhance the dynamic and flexible features of shorelines.

- **Natural, locally-found materials-**
  Hard armoring techniques often use man-made materials such as concrete, large rocks, or other structural elements not naturally found on the site. Soft shoreline stabilization techniques utilize materials that are natural and locally found such as sand, gravel, large wood, and native plants.

- **Minimal use of artificial structural elements-**
  Artificial structure elements used in hard stabilization techniques often include elements such as walls, groins, over-sized rock, anchors, and chains. Soft shoreline stabilization projects minimize or eliminate the use of artificial structural elements.

- **Sediment and detritus accumulation-**
  Hard shoreline armoring can alter sediment and detritus accumulation (Thom et al. 1994). Sediment and detritus accumulation are important shoreline habitat features (Brennan & Culverwell, 2004; Johannessen & MacLennan, 2007), and soft shorelines can be designed to allow for the natural accumulation of detritus and sediment on the beach.

- **Priority resource protection-**
  Soft shoreline projects are designed to be responsive to the needs of the drift cell and to the functions and values of priority resources such as eelgrass beds, sub-tidal clam beds, or Priority Habitats and Species (WDFW list of habitats and species with conservation or management concern). Soft shoreline projects are designed to protect or enhance habitat for priority resources affected by the site.

The above list of soft attributes encompasses the general principles. It is not expected that each soft shoreline stabilization project possesses all of the above listed soft attributes. Indeed, depending upon the shoreline characteristics, some natural shorelines in Puget Sound will not have all of these soft attributes (e.g. rocky shorelines and the soft substrate attribute). Jurisdictions should consider which soft attributes are most relevant to their specific shorelines.

These general attributes may be further divided into more specific attributes, depending upon shoreline characteristics and priorities for managing shoreline ecological functions. Jurisdictions are encouraged to develop and prioritize specific shoreline attributes that maintain or enhance shoreline ecological function along their shorelines (see Planning for Soft Shoreline Stabilization). This may be useful in evaluating where a stabilization project falls on the shoreline continuum (Figure 1) within a particular jurisdiction and for a specific site. Jurisdictions should consider soft attribute priorities based on the entire jurisdiction, shoreline reach, and specific shoreline site characteristics. Identifying and prioritizing specific soft attributes will be useful in SMP implementation through permitting of successful soft shoreline stabilization.

### Side Bar: Sea Level Rise and Soft Shoreline Stabilization

Sea level, coastal inundation, and frequency of severe high tide events are expected to increase in Puget Sound due to climate change. These factors are likely to increase shoreline erosion, which may increase requests for shoreline armoring (Johannessen & MacLennan, 2007; Shipman, 2009). However, hard armoring can prevent the shoreline from retreating landward, which can result in habitat loss, also known as coastal squeeze. Also, because armoring reduces erosion, it reduces delivery of sediment to the beach that otherwise would mitigate the effects of sea level rise on some beaches (Johannessen & MacLennan, 2007). Soft shoreline stabilization can help mitigate some of the impacts of rising sea levels. Some soft shoreline stabilization techniques may have less of a habitat impact and allow for landward migration of shoreline habitats as sea levels rise. This will, however, depend upon the location and management of the upland development the soft stabilization is built to protect. Also, soft shoreline stabilization projects that maintain or mimic natural coastal geomorphic processes (e.g. beach nourishment) may help mitigate sea level rise (Johannessen & MacLennan, 2007).

## What is NOT Soft Shoreline Stabilization?

One way to further clarify soft shoreline stabilization is to consider what it is NOT. Hard structures can have some soft attributes, and soft projects sometimes can have some hard elements (see Figure 1). One can think about how projects meet the intent of soft shorelines in order to clarify what may not be considered soft shoreline stabilization. For example, the addition of natural materials in stabilization projects is not necessarily sufficient to be labeled a soft shoreline. It is important that the project as a whole meets the intent of soft shoreline stabilization. While adding soft or natural materials to an otherwise hard structure is generally encouraged, one should consider what the project is really achieving before labeling as 'soft'.

The following is a list of some examples of what generally should not be considered soft shoreline stabilization and why. It is important to consider that these are examples only, and that each real-life project should be placed into specific context of the shoreline site and community goals when considering if it achieves the intent of soft shoreline stabilization.

- **Bulkhead or seawall with potted plants on top**
  This is not soft shoreline stabilization. Bulkheads and seawalls impound sediment and cause physical disconnection between the terrestrial and aquatic environments. Bulkheads/seawalls do not respond dynamically to changing shoreline environments and may increase erosion on adjacent properties (Thom et al. 1994; Johannessen & MacLennan, 2007; Shipman, 2010). While the potted plants may be argued to have a beneficial effect by providing some leaf litter input and possibly shade, this is not enough to meet the intent of soft shoreline stabilization. Potted plants offer no root stabilization, and little habitat or other physical process benefit.

- **Riprap revetment with some root wads**
  Riprap revetments impound sediment and can create a physical and placement disconnection between terrestrial and aquatic environments (Shipman, 2010). While they are designed to not refract as much wave energy as bulkheads and have a semi-flexible response (Cox et al. 1994), they still may cause localized scour (Williams & Thom, 2001) and erosion on adjacent and down drift properties. They also are often associated with significant displacement of backshore and vegetation habitat because they often cover more area than a vertical bulkhead. While adding root wads (a tree trunk with roots attached) may enhance habitat complexity provided by a revetment structure, this is not enough to be considered soft shoreline stabilization. This is because the overall structure is hard, habitat benefit is relatively low, and physical process benefit is limited. This is not meant to necessarily discourage the use of root wads with a revetment. However, it is important to consider that, as a whole, a project like this does not generally meet the intent of soft shoreline stabilization.

- **Large wood and rocks to create a "wall"**
  Although large wood and rocks can be used within soft shoreline stabilization, these materials can also be used in designs that essentially create a wall-like structure. A structure that functions like a hard wall should be treated as a wall and not as a soft structure, regardless of the materials it is made of. Again, while a wall made of natural materials will generally be environmentally preferred over wall structures made of concrete or other man-made materials, it may still not generally meet the intent of soft shoreline stabilization. One may also consider the original and surrounding shoreline condition and base the evaluation on whether or not a project like this will enhance ecological functions.

- **Riprap revetment with many plants within the structure**
  While the addition of native plantings to hard structures is an improvement over a bare hard structure, such as a riprap revetment, this design still does not meet the intent of soft shoreline stabilization. It is essentially a hard structure with some soft habitat elements

(plants) added. Therefore, this may be better categorized as a hybrid structure. Hybrid structures can be defined as a combination of hard and soft stabilization techniques. Hybrid structures, while preferred over hard structures, generally should not be considered soft. An exception may be in areas with high amounts of stabilization and development of the shoreline, where a replacement hybrid structure is a significant improvement over the existing hard structure. See the Shoreline Stabilization Continuum section for more discussion of hybrid structures.

For summaries of stabilization measures listed in the SMP Guidelines, please see the Ecology webpage:
http://www.ecy.wa.gov/programs/sea/shorelines/stabilization/index.html

# Part III: Planning for Soft Shoreline Stabilization

Main sections included in Part III:

- Soft Shorelines and No Net Loss
- Consistency with SMA Environmental Protection Goals and Policies
- Using SMP Update Products to Plan for Soft Shoreline Stabilization
- Developing Soft Shoreline Criteria
- Using Resources for Success

One of the main advantages of planning ahead for soft shoreline stabilization is the potential to identify soft shoreline management priorities within each jurisdiction. Appropriate planning for soft shoreline stabilization can assist local jurisdictions in successful implementation of the shoreline stabilization section within their SMPs. Soft shoreline priorities may vary based on shoreline type, environment designation, or other factors that may be prevalent within a particular jurisdiction. These priorities may influence soft shoreline objectives and definitions within each jurisdiction. The purpose of this section is to provide strategies and examples for local governments planning for soft shorelines.

As described in the section Developing Soft Shoreline Criteria, jurisdictions have discretion in the level of detail they provide in their definition of soft stabilization. A definition that is too loose runs the risk of mislabeling hard projects with some soft elements as soft, resulting in more hard structures than appropriate. However, definitions that are too restrictive may not provide the necessary design flexibility to address erosion stabilization needs and site-specific conditions, thereby discouraging potentially feasible soft stabilization solutions. Therefore, thinking ahead to develop a clear, jurisdiction-specific plan to facilitate stabilization projects that will achieve the intent of soft shoreline stabilization can serve as an important factor in the successful implementation of soft shoreline policies.

> "Allow only shoreline modifications that are appropriate to the specific type of shoreline and environmental conditions for which they are proposed." [WAC 173-26-231(2)(c)]

There are several parallel requirements that local jurisdictions already need to follow which may affect implementation of soft shoreline policies. First of all, jurisdictions should consider how soft shorelines can contribute to no net loss within their region and how soft shorelines can be used to maintain consistency with the Shoreline Management Act (SMA). In addition, existing supporting analysis from the SMP update process, such as local Shoreline Inventory and Characterization Reports and Environment Designations, may be useful in determining which soft shoreline aspects are the most important and where they are most appropriate within each jurisdiction. Based on the no net loss goal and existing information from the SMP update, jurisdictions should consider generating criteria to help identify which types of projects will be

considered soft. The following sections provide additional information for using these strategies for soft shoreline planning within local jurisdictions.

# Soft Shorelines and No Net Loss

The SMP Guidelines updated in 2003 include a "no net loss" requirement. WAC 173-26-186 (8) directs master programs to "*... include policies and regulations designed to achieve no net loss of... ecological functions.*" The intent of soft shoreline stabilization is directly applicable to no net loss of shoreline ecological functions (no net loss) in the nearshore area. Soft shoreline stabilization aims to balance erosion protection with **maintaining or enhancing nearshore ecological function**. Proper implementation of soft shoreline stabilization policies can help some jurisdictions achieve no net loss by minimizing impacts to nearshore ecological function associated with new stabilization projects and enhancing nearshore ecological function through replacement of existing hard stabilization.

Considering the no net loss policy is important when planning for soft shorelines. Planning for soft shorelines should include identification of soft attributes that maintain or enhance nearshore ecological functions or minimize the loss to these functions. These attributes can then be prioritized to clarify what is considered soft within that jurisdiction. For examples of prioritizing soft attributes, please see the Using Shoreline Inventory and Characterization Reports section.

## Soft Shorelines and 8 Year Review

Local jurisdictions will benefit from demonstrating how soft shorelines can facilitate achieving no net loss. Every eight years, local jurisdictions are required to review their updated SMP and assess whether implementation of SMP policies and regulations are achieving their intended goal. Tracking the implementation of soft shorelines will give local jurisdictions useful data demonstrating careful administration of shoreline stabilization standards, thus further supporting consistency with the no net loss policy in the SMP Guidelines.

Tracking and demonstrating no net loss of ecological function can be difficult because directly measuring ecological function can be costly and complex to document. Therefore, jurisdictions are encouraged to use no net loss tracking indicators to document the types of shoreline uses, modifications, or restoration that have occurred within shoreline areas. Tracking indicators can be used to collect information from shoreline permits and exemptions to monitor the status of shoreline ecological functions through implementation of updated SMP. Ecology has developed a list of potential tracking indicators located in the No Net Loss Chapter (Washington Department of Ecology, 2010) of the SMP Handbook. Below is a brief description of potential shoreline stabilization indicators from the No Net Loss chapter as well as a few additional suggested indicators.

- **Length of hard stabilization**
  Tracking the length of hard armoring either removed or added along the shoreline jurisdiction will help track implementation of shoreline stabilization standards, which will also facilitate evaluation of no net loss. While hard armoring can be grouped together

for a potential indicator (e.g. bulkheads, seawalls, riprap, etc.), tracking the specific type of hard armoring for potential future analysis is encouraged.

- **Length of soft stabilization**
  This category covers the other types of stabilization including: large woody debris, gravel placement, beach nourishment, and others. Tracking the length of these stabilization features will help track implementation of shoreline stabilization standards, which will also facilitate evaluation of no net loss. The impacts for each of these types of stabilization will vary, so it can be difficult to compare the benefits of removal or impacts of addition with regards to no net loss of ecological function. Keeping an itemized list of what type of stabilization was added or removed is suggested to get the full benefit of this indicator type. One of the main challenges of this indicator is confidently identifying if the stabilization is soft, hybrid, or hard armoring. Jurisdictions can also track the length of hard armoring converted to soft stabilization.

- **Area or percent cover of riparian vegetation**
  Riparian vegetation provides a multitude of ecological functions to the nearshore (Brennan & Culverwell, 2004). Therefore, it is extremely relevant to track for no net loss. As stated in the No Net Loss Handbook Chapter, planting requires no shoreline permit, so change can be difficult to track. However, riparian vegetation plantings and removal are often included in stabilization project plans and are required information for permits. Therefore, changes in the area, amount, or percent cover of riparian vegetation may be tracked through shoreline stabilization permits and can be a useful indicator.

- **Area of backshore habitat**
  Backshore habitat contributes to healthy shoreline ecological functions (Brennan & Culverwell, 2004). The backshore is a beach zone which extends landward from the sloping foreshore to a point of vegetation or slope break such as a bluff. Shoreline stabilization can significantly alter backshore habitat (Shipman, 2010) while soft shoreline stabilization projects have the potential to maintain or enhance backshore habitat or minimize the impacts to backshore habitat. The area of backshore habitat unaltered, covered, uncovered, or enhanced is a potential indicator for tracking no net loss. A main challenge of this indicator is accurately measuring the area of backshore habitat and taking into account the different habitat qualities of backshore habitat.

- **Length of stabilization on or directly adjacent to forage fish spawning habitat**
  Habitat for forage fish and salmonids has been impacted in Puget Sound by shoreline armoring (Williams et al. 2001; Brennan & Culverwell, 2004). Tracking the length of stabilization added, replaced, or removed along fish spawning habitat may be a useful indicator for tracking no net loss of ecological function related to fish habitat. Soft shoreline stabilization projects have the potential to maintain or enhance spawning habitat or minimize the impacts to spawning habitat (Williams et al. 2001). Therefore, tracking the type of shoreline stabilization (hard vs. soft) within this indicator may be beneficial in evaluating no net loss.

- **Length of stabilization on feeder bluffs**
  Feeder bluffs contribute sediment to beaches through natural erosion processes. Impoundment of sediment (disconnecting sediment from entering the nearshore zone) has been identified as a main impact of traditional hard shoreline armoring (e.g. bulkheads on feeder bluffs). Allowing sediment to erode and enter the nearshore system is a key physical process that is a foundation of Puget Sound nearshore health (Johannessen & MacLennan, 2007). Therefore, the length of any new armoring or armoring removal on feeder bluffs may be a useful indicator to track. One limitation of this potential indicator is the identification of feeder bluffs with currently armored shorelines.

For more comprehensive information on no net loss and SMP updates, please see the No Net Loss Chapter in the SMP Handbook provided by Ecology (http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/index.html).

**Jurisdiction Example: City of Kirkland and Tracking No Net Loss Indicators**

The City of Kirkland has developed a method for tracking potential no net loss indicators through information collected from shoreline permits *and* exemptions. Kirkland created a detailed Excel spreadsheet with specific categories to organize data entries and track changes in the shoreline environment due to permitted activities. Kirkland enters information for potential no net loss indicators for each shoreline permit or exemption issued, including city projects. These indicators include metrics such as the number new native shoreline trees planted, changes in nearshore shrub and groundcover area (removal of non-native and planting of native) within the shoreline setback, linear feet of soft and hard stabilization removed/ added/repaired, change in shoreline set back, etc. It is an extra step for staff in the permit process, but Kirkland anticipates that it will be highly beneficial in evaluating SMP performance and informing any amendments at the eight year review.

For more information on Kirkland's tracking spreadsheet, contact:
Teresa Swan, Senior Planner at tswan@kirklandwa.gov, (425) 587-3258 or
Christian Geitz, Assistant Planner at cgeitz@kirklandwa.gov, (425) 587-3246

# Consistency with SMA Environmental Protection Goals and Policies

The purpose of this section is to describe how soft shoreline stabilization can be used to maintain consistency with SMA environmental protection goals and policies. Consistency with the SMA and the SMP Guidelines is a universal requirement of all jurisdictions, regardless of the condition (impaired or intact) of a jurisdiction's shoreline. This is distinct from the no net loss requirement, which is based on evaluation of a specific jurisdiction. The RCW and WAC mention the protection and restoration of shoreline ecological functions on several occasions.

The SMP Guidelines state a general policy goal related to protection and restoration:

> **"Protection and restoration of the ecological functions of shoreline natural resources"** [WAC 173-26-176 (3)(c)].

This policy goal is derived from the following statutory language found in RCW 90.58.020 (emphasis added):

> "The legislature finds that the shorelines of the state are among the most valuable and fragile of its natural resources and that there is great concern throughout the state relating to their **utilization, protection, restoration,** and **preservation**."

> "This policy contemplates **protecting against adverse effects** to the public health, the land and its vegetation and wildlife, and the waters of the state and their aquatic life. . ."

> "To this end **uses shall be preferred** which are consistent with the control of pollution and **prevention of damage to the natural environment**."

> "**Permitted uses** in the shorelines of the state shall be designed and conducted in a manner to **minimize**, insofar as practical, any resultant **damage to the ecology and environment** of the shoreline area. . ."

WAC 173-26-201, which outlines the process to follow when preparing or amending SMPs, states: "*Master programs shall also include **policies that promote restoration of ecological functions**, as provided in WAC 173-26-201 (2)(f), where such functions are found to have been impaired based on analysis described in WAC 173-26-201 (3)(d)(i)...The **goal** of this effort **is master programs which** include planning elements that, when implemented, serve to **improve the overall condition of habitat and resources** within the shoreline area of each city and county.*" (emphasis added) [WAC 173-26-201 (2)(c)].

The WAC also states: "*Consistent with principle WAC 173-26-186 (8)(c), **master programs shall include goals, policies and actions for restoration of impaired shoreline ecological functions**. These **master program provisions** should be **designed to achieve overall improvements in shoreline ecological functions over time**, when compared to the status upon adoption of the master program.*" (emphasis added) [WAC 173-26-201 (2)(f)].

While a separate restoration plan identifying potential public and private restoration projects is created as a part of the SMP update process, implementing SMP regulations also provides opportunities for ecological restoration, where feasible and appropriate.

Consider the following simplified example: Upon completion of the Shoreline Inventory and Characterization Report, Jurisdiction A discovers that 60% of their shoreline is stabilized with hard shoreline armoring. Assume that no new development requiring any type of shoreline stabilization will occur on the other 40% of shoreline. Simply applying the no net loss policy would allow each parcel along the 60% of hardened shoreline to replace the hard structure in-

kind. However, if Jurisdiction A were to maintain consistency with the SMA through the implementation of their SMP, shoreline permits and exemptions to replace these hard stabilization structures would still be required to go through mitigation sequencing (avoid, minimize, mitigate). In this scenario, mitigation sequencing would include demonstrating need for erosion control and demonstrating soft shoreline stabilization options are not feasible before a replacement of an in-kind structure is permitted. Over time, successful implementation of the updated SMP through replacement permit requests may lead to less than 60% hard armoring within this jurisdiction, with increases in soft shoreline stabilization and unarmored sites. If designed with the appropriate soft attributes, these new soft shorelines and unarmored shorelines would improve shoreline ecological functions within Jurisdiction A.

> "Avoid and reduce significant ecological impacts according to the mitigation sequence in WAC 173-26-201 (2)(e)." [WAC 173-26-201(2)(g)]

Jurisdictions are responsible for satisfying both no net loss and consistency with SMP Guideline requirements. It is, therefore, appropriate for jurisdictions to plan for soft shoreline stabilization and determine how it can best be used to protect and restore shoreline ecological functions.

For more information on mitigation sequencing and SMPs please see SMP Handbook Chapter 4. A detailed discussion of wetland mitigation sequencing can be found in The Science and Effectiveness of Wetland Mitigation, Section 6.2.

# Using SMP Update Resources to Plan for Soft Shoreline Stabilization

When planning for soft shoreline stabilization, jurisdictions can use the products from their local SMP update process. Jurisdictions that are in the midst of an SMP update are encouraged to think about soft shoreline stabilization planning when developing the Shoreline Inventory and Characterization Report, Environment Designations, and the shoreline stabilization section within the SMP. Jurisdictions that have completed their updated SMP can use these products in addition to their SMP shoreline stabilization section regulations when planning and implementing soft shorelines. The purpose of this section is to provide examples for how jurisdictions can use Shoreline Inventory and Characterization Reports and Environment Designations to plan for soft shoreline stabilization.

## Using Shoreline Inventory and Characterization Reports

Shoreline Inventory and Characterization Reports are fundamental for SMP updates. The information within these reports may be useful in determining which soft shoreline stabilization attributes could be prioritized within jurisdictions' shoreline areas.

The inventory and characterization should have identified shoreline ecological processes and functions that are relevant within the community. Jurisdictions can use these identified processes and functions to determine which shoreline armoring impacts are of significant concern to their

community. Once these impacts have been identified, jurisdictions can then determine which *soft* shoreline stabilization attributes may minimize these impacts. These soft attributes can be prioritized based on severity of the armoring impact and priorities for protection and restoration within the jurisdiction. These prioritized soft attributes can then inform what is considered soft within a jurisdiction. Jurisdictions are also encouraged to use any management recommendations created from the shoreline characterization analysis related to shoreline stabilization to inform which soft attributes are most appropriate to meet these recommendations. This process is represented in the decision framework presented in Figure 3.

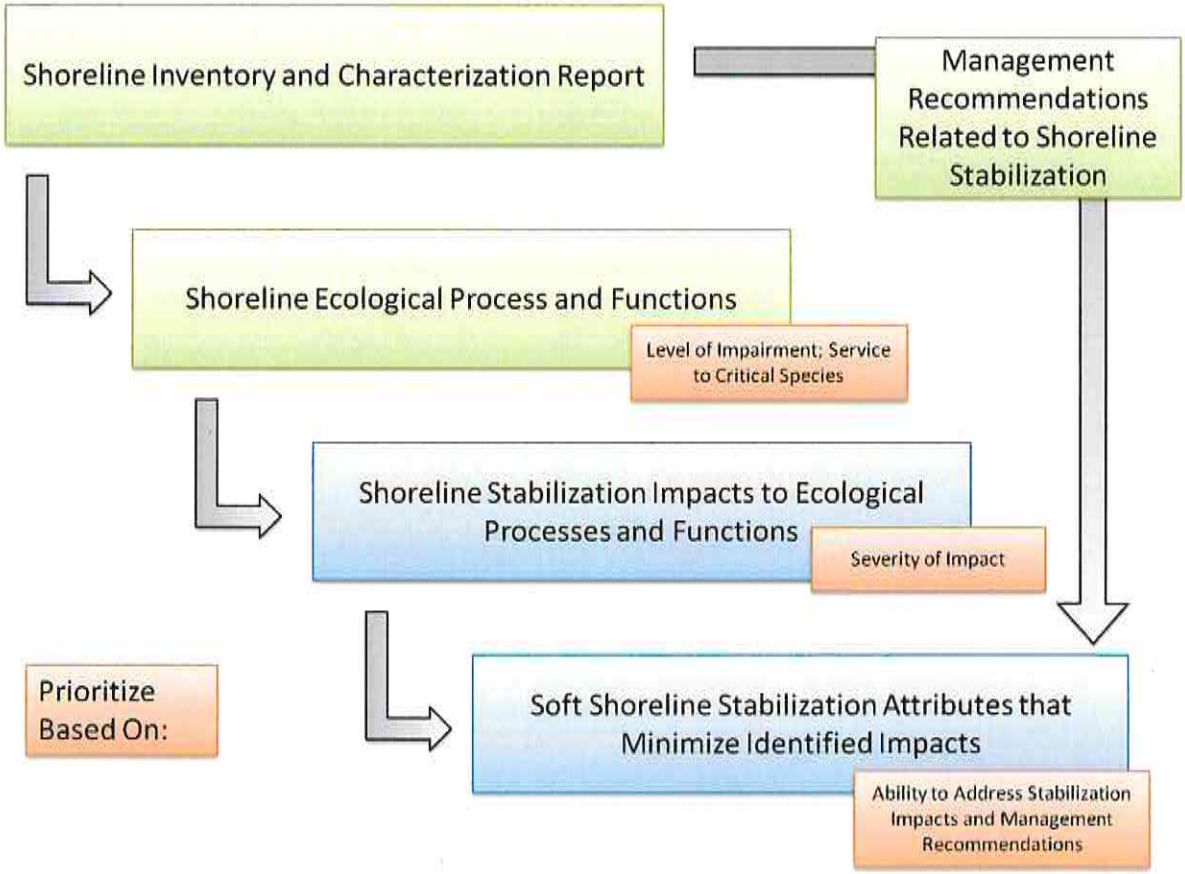


**Figure 3: Decision framework for identifying soft shoreline stabilization attributes.**

The following are hypothetical examples of two different jurisdictions using their Shoreline Inventory and Characterization Reports with the decision framework in Figure 3 to prioritize soft attributes and determine what may qualify as a soft shoreline project for single family residences.

**Example A:**
County jurisdiction A has a relatively long shoreline along Puget Sound. The inventory of County A's shoreline revealed that the landscape is a mixture of low to high bluffs, spits and lagoons. The drift cells within this jurisdiction are long and there are sections of shoreline which are actively eroding and accreting. The analysis and characterization revealed that the ecological process of **sediment availability and transport was important** in this community to provide

key habitat functions as well as to minimize erosion on down drift properties to protect homes and recreational beaches. The inventory and characterization also identified **forage fish spawning habitat as critical** within this jurisdiction.

As a result of the inventory and characterization analysis, **sediment availability and transport and forage fish spawning habitat were identified as conservation and restoration priorities** in order to meet no net loss and SMA consistency. This jurisdiction then reviewed impacts commonly associated with shoreline stabilization that were relevant to sediment movement and forage fish habitat. Attributes of soft shoreline stabilization that could minimize the impacts commonly associated with hard shoreline stabilization were identified. These attributes were then used to provide examples of the type of stabilization project features that may qualify as soft within this jurisdiction. The result of this process is shown in Table 1.

**Table 1: Jurisdiction A example soft shoreline stabilization attribute priorities derived from shoreline process or functions.**

| Shoreline Process or Function | Shoreline Stabilization Impact | Soft Shoreline Stabilization Attributes | Examples: |
|---|---|---|---|
| Sediment availability | Impound sediment | Does not significantly alter the amount of sediment entering the system | Projects that still allow some natural erosion; OR projects that use periodic beach nourishment/gravel placements that add appropriate amounts of sediment to the system. |
| Sediment transport | Impede longshore sediment drift | Allows sediment to travel along the drift cell | Projects that do not use structures that would act as groins within the drift cell. |
| Forage fish spawning | Scour and coarsen sediment;<br>Displace shading riparian vegetation | Flexible materials that do not increase on site erosion and sediment scour;<br>Natural materials that are the appropriate size for fish spawning;<br>Plantings and retention of natural riparian vegetation | Projects that utilize spawning gravel;<br>Projects with limited use of hard structures near the high tide line;<br>Projects that use native vegetation that provides shade |

**Example B:**
City jurisdiction B has a moderate length of shoreline along Puget Sound. The shoreline inventory revealed that many shoreline parcels have low banks with relatively low rates of erosion and low rates of longshore drift. The analysis and characterization revealed that the shoreline ecological process of vegetation cover was important in this community to provide **key habitat functions such as backshore and intertidal habitats.** These habitats are important for forage fish spawning, juvenile salmon, eelgrass, and invertebrates.

As a result of the inventory and characterization analysis, **shoreline backshore and intertidal habitats were identified as conservation and restoration priorities** in order to meet no net loss and SMA consistency. Similar to Jurisdiction A, Jurisdiction B then reviewed shoreline stabilization impacts relevant to their recognized habitat functions. The jurisdiction identified attributes of soft shoreline stabilization that could minimize the impacts, and identified soft stabilization project feature examples. The results from jurisdiction B are shown in Table 2.

As evident from the two examples, each jurisdiction may have similar or different priorities concerning ecological processes and functions. These priorities influence what types of soft shoreline attributes are most relevant within each jurisdiction. Keep in mind that these are simplified examples. Jurisdictions are encouraged to consider all relevant shoreline ecological processes and functions during the prioritization process. Processes and functions may be prioritized depending upon level of impairment, services to critical or sensitive species, or additional factors deemed important by the local jurisdiction. Prioritizing ecological processes and functions, stabilization impacts, and soft attributes will ultimately help during permit review of soft, hybrid, and hard stabilization projects.

Shoreline Inventory and Characterization Reports will vary in resolution between local jurisdictions due to jurisdiction size, availability of information, and shoreline complexities. County jurisdictions may have more variety of shoreline types and existing development, which may make prioritizing soft attributes on a jurisdiction-wide scale more difficult. Some jurisdictions may choose to use the decision framework to identify soft attributes at a jurisdiction level, while others may have sufficient characterization to identify soft attributes at a reach or site specific level. Some jurisdictions may not have enough information to identify soft attributes.

**Key Point: The types of soft shoreline attributes that will be most relevant will vary between jurisdictions.**

**Table 2: Jurisdiction B example soft shoreline stabilization attribute priorities derived from shoreline process or functions.**

| Shoreline Process or Function | Shoreline Stabilization Impact | Soft Shoreline Stabilization Attributes | Examples: |
|---|---|---|---|
| Backshore/upper beach habitat | Displace backshore habitat, including vegetation;<br>Reduce shade;<br>Reduce large woody debris accumulation;<br>Impede terrestrial-aquatic connectivity;<br>Scour and coarsen sediment | Natural locally found materials that are reflective of natural habitat conditions and appropriate size for fish spawning;<br>Minimal use of artificial structures and materials;<br>Allow for transfer of terrestrial material into aquatic system | Projects that utilize soft, naturally occurring materials such as sediment, large wood and vegetation;<br>Projects that utilize spawning gravel;<br>Projects that use no or limited amounts of artificial elements;<br>Projects that incorporate overhanging vegetation for material input and shade |
| Intertidal habitat | Scour and coarsen sediment;<br>Passive erosion;<br>Steepen shoreline gradient | Soft, natural materials;<br>Flexible design and materials;<br>Low gradients | Projects that do not steepen the natural gradient of the shoreline;<br>Projects that utilize flexible designs and natural materials to reduce scour and intertidal erosion;<br>Projects that utilize appropriate sediment materials for invertebrate habitat |

## Using Environment Designations

The establishment of environment designations through the SMP update process may have direct applicability to planning for soft shoreline stabilization. Environment designations are intended to act like "zoning". They are designed to signify distinct characteristics between shoreline condition and current, historical, and potential uses. This step in the SMP update process is intended to allow jurisdictions to plan for future uses while maintaining no net loss. Depending upon jurisdiction characteristics, environment designations may be a useful planning tool for identifying appropriate opportunities for soft shoreline stabilization implementation. This will depend on the differences between and within environment designations within a jurisdiction, as well as the level of detail available regarding shoreline characteristics and restoration/enhancement opportunities for each environment designation.

Environment designations may be utilized as a framework for determining where soft shoreline stabilization techniques may or may not be appropriate, identifying opportunities for soft shorelines, and possibly identifying parameters for what may or may not qualify as soft per environment designation. There may also be the opportunity to exercise more rigorous review efforts of stabilization projects (including soft and hard) within specific environment designations where the most ecological benefit can be gained from environmental protection and soft shoreline implementation. For an example of different soft and hard stabilization permit requirements between environment designations, see Jurisdiction Example: City of Federal Way.

To provide examples of how jurisdictions may use environment designations to plan for soft shorelines, a list of the common environment designations given in the SMP Guidelines is presented here. Under each environment designation is the purpose as dictated in the SMP Guidelines, possible soft shoreline stabilization opportunities and constraints, and implications for soft shoreline treatments. The soft shoreline stabilization opportunities, constraints, and implications for soft shoreline treatments are presented as options for local jurisdictions to plan for and implement soft shorelines for single family residences.

For a full discussion of each environment designation and the associated management policies and designation criteria, please see WAC 173-26-211(5).

### Natural

*The **purpose** of the "natural" environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes. Consistent with the policies of the designation, local government should include planning for restoration of degraded shorelines within this environment. [WAC 173-26-211(5)(a)(i)]*

### Soft Shoreline Stabilization Opportunities

- New armoring requested for existing residences should be subject to extensive review and the softest possible alternative should be implemented.
- Structures and uses with existing hard stabilization should be highly encouraged to implement soft shoreline stabilization to replace hard stabilization when feasible.

### Soft Shoreline Stabilization Constraints

- New residential development should not be located where any type of stabilization will be needed, including soft stabilization.
- Natural shorelines and shoreline restoration should be preferred and implemented over soft shoreline stabilization treatments.

### Implications for Soft Shoreline Treatments

- The highest standards for soft shoreline stabilization projects to include soft attributes that maintain or enhance ecological processes and functions should be implemented.
- Soft shoreline stabilization projects should match the surrounding natural environment to the maximum extent possible.

Note: "Natural" shoreline designation and "natural shoreline" are two different terms. "Natural shorelines" are shorelines that have been undisturbed by direct modifications. The "Natural" shoreline designation is an environment designation used for planning purposes. Therefore, natural shoreline conditions may exist in a variety of shoreline environment designations.

## Rural Conservancy

*The **purpose** of the "rural conservancy" environment is to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural flood plain processes, and provide recreational opportunities... [WAC 173-26-211(5)(b)(i)]*

### Soft Shoreline Stabilization Opportunities

- New armoring requested for any existing residences should be subject to extensive review and the softest possible alternative should be implemented.
- Structures and uses with existing hard stabilization should be highly encouraged to implement soft shoreline stabilization to replace hard stabilization when feasible.

### Soft Shoreline Stabilization Constraints

- New residential development should not be located where any type of stabilization will be needed, including soft stabilization.

- Natural shoreline protection and restoration should be preferred and implemented over soft shoreline stabilization treatments.

### Implications for Soft Shoreline Treatments

- High standards for soft shoreline stabilization projects to include soft attributes that maintain or enhance ecological processes and functions should be implemented. Those options which maintain or enhance physical and biological processes should be considered over those that do not.
- Soft shoreline stabilization projects should match the surrounding natural environment to the maximum extent possible.

## Aquatic

*The **purpose** of the "aquatic" environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark. [WAC 173-26-211(5)(c)(i)]*

### Soft Shoreline Stabilization Opportunities

- Soft shorelines may minimize the potential impacts to aquatic designations when new stabilization is required.
- Soft shorelines may enhance ecological processes and functions within aquatic designations when replacing hard armoring.

### Soft Shoreline Stabilization Constraints

- Soft stabilization projects should minimize extension of stabilization treatments into the aquatic designation as much as possible without compromising the success of the stabilization project.
- Regrading and fill should NOT result in the expansion of upland areas.

### Implications for Soft Shoreline Treatments

- Activities such as regrading and fill below the ordinary high water mark should only be allowed for accommodating the success of soft shorelines projects.
- Any soft shoreline stabilization treatment that extends into the aquatic designation should minimize the impact to ecological functions and processes to the maximum extent possible.
- Other authorities with jurisdiction, such as WDFW, ACOE, Ecology, and WDNR may have standards or permit requirements regarding activities within the Aquatic designation.

Note: Single family residential use is not an allowed use within the Aquatic designation. Management of shoreline stabilization mostly relates to shoreland designations and protection of structures and uses. However, because soft shoreline stabilization methods may extend into the Aquatic designation due to technique and design requirements, it is important to consider the potential impacts and benefits of soft shorelines to the Aquatic designation.

Soft shoreline stabilization activities that require use of fill have the potential to encroach on state-owned aquatic lands managed by the Washington Department of Natural Resources (WDNR). WDNR is the proprietary manager of state-owned aquatic lands, and is directed to manage these lands for a balance of public benefits, including environmental protection. Before significant resources are allocated to soft shoreline stabilization activities, it is very important to consult with WDNR at the early stages of both design and permitting to identify if the project is on state-owned aquatic lands and if these lands are available. More information is available at WDNR's Leasing State-Owned Aquatic Lands webpage: http://www.dnr.wa.gov/BusinessPermits/Topics/ShellfishAquaticLeasing/Pages/aqr_aquatic_land_leasing.aspx

### High Intensity

*The **purpose** of the "high-intensity" environment is to provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded. [WAC 173-26-211(5)(d)(i)]*

#### Soft Shoreline Stabilization Opportunities

- Currently armored shorelines undergoing new development or redevelopment should be encouraged to use soft shoreline stabilization approaches when feasible as a part of the new or redevelopment.

#### Soft Shoreline Stabilization Constraints

- Soft shoreline stabilization may be limited in feasibility and success due to high volumes of water traffic and infrastructure requirements to support existing uses.

#### Implications for Soft Shoreline Treatments

- Soft shoreline stabilization approaches may include combined hard and soft techniques (hybrids) due to the predominant existence of hard structures and high marine traffic.
- "Soft" attributes in these situations may be limited to modest improvements such as vegetation, bulkhead setbacks, and pocket beaches.

## Urban Conservancy

*The **purpose** of the "urban conservancy" environment is to protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses. [WAC 173-26-211(5)(e)(i)]*

### Soft Shoreline Stabilization Opportunities

- New armoring requested for existing residences should be subject to extensive review and the softest possible alternative should be implemented.
- Structures and uses with existing hard stabilization should be highly encouraged to implement soft shoreline stabilization to replace hard stabilization when feasible.

### Soft Shoreline Stabilization Constraints

- New residential development should not be located where any type of stabilization will be needed, including soft stabilization.
- Natural shoreline protection and restoration should be preferred and implemented over soft shoreline stabilization treatments.

### Implications for Soft Shoreline Treatments

- High standards for soft shoreline stabilization projects to include soft attributes that maintain or enhance ecological processes and functions should be implemented. Those options which maintain or enhance physical and biological processes should be considered over those that do not.
- Soft shoreline stabilization projects should match the surrounding natural environment to the maximum extent possible.

## Shoreline Residential

*The **purpose** of the "shoreline residential" environment is to accommodate residential development and appurtenant structures that are consistent with this chapter. An additional purpose is to provide appropriate public access and recreational uses. [WAC 173-26-211(5)(f)(i)]*

### Soft Shoreline Stabilization Opportunities

- If a currently undeveloped area is already zoned for single family residence development, soft shoreline stabilization should be implemented as the shoreline stabilization method if needed.
- New armoring requested for existing residences should be subject to extensive review and the softest possible alternative should be implemented.

- Structures and uses with existing hard stabilization should be highly encouraged to implement soft shoreline stabilization to replace hard stabilization when feasible.
- Requests for replacement armoring should be subject to review and projects with soft attributes should be implemented.

### Soft Shoreline Stabilization Constraints

- New residential development should not be located where any type of stabilization will be needed, including soft stabilization.
- Small lot sizes may limit the feasibility and techniques of soft shoreline stabilization.
- Some reaches may be unsuitable for soft shoreline stabilization due to proximity of the residences to the water.

### Implications for Soft Shoreline Treatments

- Standards for soft shoreline stabilization projects to include soft attributes that maintain or enhance ecological processes and functions should be implemented. Those options which maintain or enhance physical and biological processes should be considered over those that do not.
- Appropriate soft shoreline techniques may be influenced by current and surrounding shoreline conditions. Areas which are highly developed should focus on incremental improvement from the use of soft attributes, while areas with limited development should focus on maintaining ecological function through the use of soft attributes.
- Soft shoreline stabilization projects should match the surrounding natural environment when feasible.

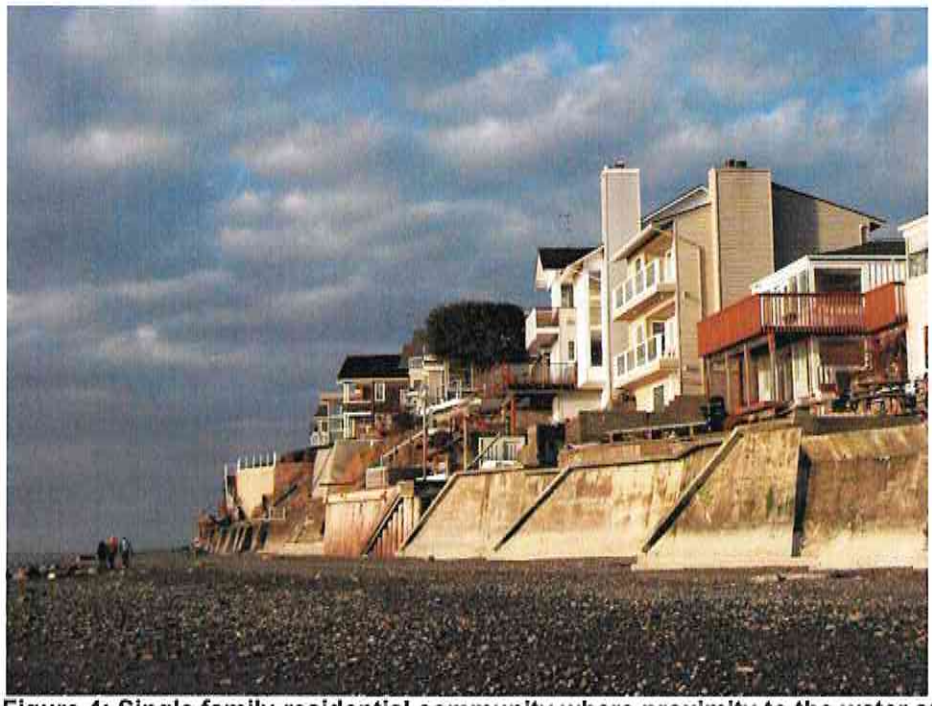

**Figure 4: Single family residential community where proximity to the water and current development condition may limit soft shoreline stabilization feasibility.**
(Hugh Shipman photo.)

### Jurisdiction Example: City of Federal Way Environment Designations

The City of Federal Way's SMP, approved by Ecology November 2011, identifies three environment designations: Natural, Urban Conservancy, and Shoreline Residential. Based on environment designation intent and current shoreline condition, the City of Federal Way chose to manage shoreline stabilization permits differently between these three environment designations. The permit differences are summarized in Table 3.

Prohibiting both soft and hard shoreline stabilization in the Natural designation is consistent with the designation's purpose, since both types of stabilization may negatively impact ecological functions and processes within this designation. The differences in permit requirements within the Urban Conservancy designation between hard and soft shoreline stabilization is appropriate. This is because it will result in more review process for hard stabilization in a designation where the purpose is to protect and restore ecological functions on sensitive lands in the urban environment. Due to the extent of current shoreline stabilization and location of residences within the Shoreline Residential designation, hard stabilization is allowed without a Conditional Use Permit (Table 3). However, both soft and hard stabilization must meet specific criteria before they are permitted [Federal Way Revised Code 15.05.050(1)(a)].

**Table 3: Soft and hard stabilization permit differences between environment designations in City of Federal Way's updated SMP.**

| Shoreline Stabilization | Shoreline Environment | | |
|---|---|---|---|
| | Shoreline Residential | Urban Conservancy | Natural |
| Soft | Permitted[1] | Permitted[1] | Prohibited |
| Hard | Permitted[1] | Conditional Use Permit | Prohibited |

Adapted from Federal Way Revised Code 15.05.070(5).
[1]Allowed as potentially exempt from a shoreline substantial development permit.

Jurisdictions are encouraged to think about the opportunities, constraints, and implications for soft shoreline stabilization within their own designations. Specific outcomes may differ from the suggestions given in this guidance. It is important for jurisdictions to consider their circumstances and determine if this is an appropriate framework to utilize for soft shoreline management.

A potential benefit of utilizing environment designations as a framework for soft shoreline stabilization management is implementation of soft shoreline projects which better achieve the intent and priorities of each shoreline designation. This can avoid a "one-size fits all" approach that is either too restrictive or too lenient on what may be feasible as a soft shoreline option. This also may reduce the effort required by the local jurisdiction or applicant to achieve SMA consistency. Jurisdictions may go so far as to set specific standards on what may qualify as "soft" for each environment designation. The success of this strategy is highly dependent upon jurisdiction specifics including shoreline complexity, similarity of shoreline reaches within environment designations, data availability, and other factors.

**Key Point: Soft shoreline stabilization techniques and regulations may differ between environment designations.**

# Developing Soft Shoreline Criteria

Identifying local criteria for soft shoreline stabilization is encouraged and appropriate. As demonstrated in previous sections, it is important that criteria be developed to encourage maintenance and enhancement of ecological functions as well as to provide flexibility for appropriate design and successful erosion protection. The purpose of this section is to provide examples of how some jurisdictions have approached defining and setting standards for soft stabilization within their updated SMPs.

We understand that the level of specificity for soft shoreline criteria will vary between jurisdictions. The ability for local jurisdictions to set specific soft shoreline stabilization criteria within SMP definitions and provisions will depend greatly upon a jurisdiction's current understanding of: shoreline ecological process and function data, shoreline residential

development data, shoreline complexity, and many other technical factors. The availability of resources for collecting and analyzing relevant data to create soft shoreline criteria will also greatly influence the level of specificity that can be achieved. In some jurisdictions, information provided in the Shoreline Inventory and Characterization Reports generated for the SMP updates may serve as a helpful tool in determining the level of specificity that may be achieved for soft shoreline stabilization criteria (see the Using Shoreline Inventory and Characterization Reports section).

When writing the updated SMP, jurisdictions may want to develop either specific standards (prescriptive) or general standards that can adapt to a variety of situations. Factors that influence which approach (specific, general, or a combination thereof) to use include, but are not limited to: distance of shoreline, complexity of shoreline reaches, levels of shoreline development, and understanding of ecological processes. Some jurisdictions may have enough information to specify standards based upon environment designation (see Using Environment Designations) or specific shoreline reaches.

The following are four examples of how two county and two city jurisdictions have defined the term "soft" (or similar term) and set standards related to soft shoreline stabilization within their updated SMP. The Whatcom County example demonstrates some advantages to applying more general SMP provisions to a variety of situations on a case-by-case basis. Whereas the City of Kirkland example provides a different approach by specifying the types of soft approaches that are preferred and clearly stating the requirements for demonstration of feasibility and soft technique expectations for all stabilization proposals.

**Jurisdiction Example: Whatcom County SMP Soft Shoreline Stabilization Definition**

Whatcom County SMP Locally Adopted February 2007 and Ecology Approved August 2008

Whatcom County's SMP clearly states a preference for "soft" stabilization over hard:

> "Where shore stabilization is allowed, it shall consist of **"soft", flexible, and/or natural materials or other bioengineered approaches** unless a geotechnical analysis demonstrates that such measures are infeasible" [Whatcom County Code 23.100.130(B)(1)(d)].

The SMP regulations also state a preference hierarchy beginning at no action to flexible to rigid stabilization measures [Whatcom County Code 23.100.130(A)(12)].

Whatcom County's SMP does not explicitly define the term "soft", but does define the term bioengineered:

> " **'Bioengineered Shoreline Stabilization'** means **biostructural and biotechnical alternatives to hardened structures (bulkheads, walls) for protecting slopes or other erosive features**. Bioengineered stabilization **uses vegetation, geotextiles, geosynthetics and similar materials**. An example is Vegetated Reinforced Soil Slopes (VRSS), which uses vegetation

arranged and embedded in the ground to prevent shallow mass-movement and surficial erosion" [Whatcom County Code 23.110.020(B)].

Beach nourishment, vegetation stabilization, and protective berm are also mentioned in the SMP as alternatives to structures for shore protection in addition to bioengineered [Whatcom County Code 23.100.130(A)(12)(b)]. Whatcom County has given some flexibility to the interpretation of the term "soft" to allow limited anchoring rock, large wood, or other natural materials to be included along with bioengeering. However, the County's SMP does give a bulkhead definition that provides distinction for implementing a soft, flexible definition. A "**bulkhead**" is defined as *"...**a wall-like structure** such as a revetment or seawall that is **placed parallel to shore** primarily for retaining uplands and fills prone to sliding or sheet erosion, and to protect uplands and fills from erosion by wave action."* [Whatcom County Code 23.110.020(B)(15)]. The two definitions are used by Whatcom staff with technical expertise to distinguish between soft stabilization and bulkheads.

According to Whatcom County, the use and definitions of "soft", bioengineered, alternative stabilization, and bulkheads within the SMP has generally been successful for implementing soft shoreline stabilization where it is feasible and "softening" the harder stabilization projects. Whatcom County does note that a large part of its success in using this approach is due to the expertise of practiced shoreline administrator specialists assisted by technical support including an on-staff licensed engineering geologist. Without experienced staff, the flexible approach to the interpretation may not be as successful.

As far as setting specific criteria based upon ecological processes and function, the Whatcom County SMP simply emphasizes ecological protection and states:

"Shore stabilization should be located, designed, and maintained to protect and maintain shoreline ecological functions, ongoing shore processes, and the integrity of shore features. Ongoing stream, lake or marine processes and the probable effects of proposed shore stabilization on other properties and shore features should be considered..." [Whatcom County Code 23.100.130(A)(1)].

For each individual shoreline stabilization proposal, Whatcom requires a case-by-case review for potential impacts to the environment and how projects can minimize and mitigate these impacts.

In summary, Whatcom's approach uses a flexible SMP definition for soft and bioengineering which is complemented by individual proposal review to allow for site specific solutions. The flexible system works because of a specialist SMP administrator supported by licensed professionals on staff.

**Jurisdiction Example: Kitsap County SMP Soft Shoreline Stabilization Definition**

Kitsap County SMP Locally Adopted January 2013 and in Ecology Review

Kitsap County's SMP states a preference for soft shoreline stabilization measures, and identifies a preference order for alternative stabilization types and actions within their regulations:

"**Soft shoreline stabilization measures shall be utilized** unless demonstrated through a geotechnical analysis not to be sufficient to protect primary structures, dwellings and businesses. **Alternatives** for shoreline stabilization **shall be based on the following order of preference**:

a. **No action**, increase building setbacks, or relocate structures;

b. **Soft** shoreline stabilization constructed of natural materials **including bioengineering, beach nourishment, protective berms, or vegetative stabilization**;

c. **Hybrid** shoreline stabilization, **usually** constructed of **a mix of rock, logs and vegetation**;

d. **Hard** shoreline stabilization constructed of materials such as **rock, riprap or concrete.**" (Kitsap County Shoreline Master Program Draft 7.16.4.A.3)

Under the SMP definition of Shoreline Stabilization, Kitsap County lists a range of measures that qualify as either soft or hard (Table 4). To help clarify the distinction between soft and hard stabilization, Kitsap has also included a description of a third "hybrid" category:

" '**Hybrid**' structures are a **composite of both soft and hard elements** along the length of the armoring" (Kitsap County Shoreline Master Program Draft Chapter 2).

**Table 4: Possible soft and hard stabilization measures listed in Kitsap County's SMP Locally Adopted Draft.**

| Soft | Hard |
|---|---|
| Vegetation enhancement | Rock revetments |
| Beach enhancement | Gabions |
| Bioengineering measures | Groins |
| Anchor logs and stumps | Bulkheads |
| Gravel placement/beach nourishment | Seawalls |

Adapted from Kitsap County Shoreline Master Program Draft Chapter 2: Definitions-Shoreline Stabilization.

Kitsap County's regulations state that *"(s)horeline stabilization structures shall not result in a net loss of shoreline ecological functions"* (Kitsap County Shoreline Master Program Draft 7.16.4.A.13). The shoreline stabilization permit application requirements in the updated SMP specifically require information related to shoreline ecological functions and processes such as:

"…a **description of alternatives** to hard approaches where proposed, and a thorough **discussion of** the **environmental impacts of each alternative**"

"**Habitat survey** prepared by a qualified professional biologist that **describes the anticipated effects** of the project **on fish and wildlife resources and marine vegetation**"

"(a) description of any **proposed vegetation removal**, and **a plan to re-vegetate** the site following construction"

"**Direction of net longshore drift** (for marine shoreline)" (Kitsap County Shoreline Master Program Draft 7.16.3).

By clearly stating their preference and requiring relevant supporting analysis, the County will be able to consider case-by-case reviews of potential ecological process and function impacts for each shoreline stabilization permit. The SMP also qualifies that ***"(s)horeline stabilization on marine feeder bluffs... may require** additional **mitigation measures**, including those necessary to offset the loss of sediment supply"* (Kitsap County Shoreline Master Program Draft 7.16.4.A.13). This reflects that Kitsap recognizes the importance of maintaining sediment supply as necessary to support ecological processes within the County.

**Jurisdiction Example: City of Federal Way SMP Soft Shoreline Stabilization Definition**

City of Federal Way SMP Approved by Ecology November 2011

The City of Federal Way's updated SMP prioritizes soft shoreline stabilization over hard and provides some relevant examples of what qualifies as soft within their regulations:

"**Soft-shore stabilization** alternatives such as **slope drainage systems, vegetative growth stabilization, gravel berms, and beach nourishment shall be prioritized over structural options** such as bulkheads and riprap. The **"softest" effective alternative shall be utilized**" [Federal Way Revised Code 15.05.050(1)(a)(ii)].

The City's SMP also defines "soft-shore bank stabilization" including identification of some specific measures:

" '**Soft-shore bank stabilization**' means the use of **bioengineering or biotechnical bank stabilization** measures where **vegetation, logs, rock, and beach nourishment** are used to address erosion control and slope stability" [Federal Way Revised Code 15.05.030].

The updated SMP also clearly defines bulkhead in such a way that helps to distinguish soft-shore stabilization from bulkheads:

" '**Bulkhead**' means a **wall, seawall, embankment, or other structure** erected at or near the OHWM and **roughly parallel to the shoreline** that **retains or prevents sliding or erosion of land or protects** land and/or structures **from wave or current action**" [Federal Way Revised Code 15.05.030].

This approach may be used to "bookend" inappropriate characterization of bulkheads as a soft shore proposal. For example, the substantial use of rocks and/or logs in a stabilization project may fall under the definition of bulkhead rather than soft-shore bank stabilization.

The City of Federal Way is fairly general in their SMP regulations with regards to shoreline stabilization and no net loss of ecological functions:

"Shoreline stabilization shall not otherwise result in a net loss of ecological functions" [Federal Way Revised Code 15.05.050(1)(a)(xiii)].

However, Federal Way's Comprehensive Plan policy SMPP41 and regulation for sediment transport [Federal Way Revised Code 15.05.050(1)(a)(vi)] may give Federal Way some authority to include habitat and sediment transport processes as soft attributes and criteria in applicable circumstances.

"Areas of significance in the **spawning, nesting, rearing, or residency of aquatic and terrestrial biota should be given special consideration in review of** proposed **shoreline stabilization activities**" [City of Federal Way Comprehensive Plan 11.5 SMPP41].

"The applicant shall demonstrate that **impacts to sediment transport are minimized to the greatest extent possible**" [Federal Way Revised Code 15.05.050(1)(a)(vi)].

**Jurisdiction Example: City of Kirkland SMP Soft Shoreline Stabilization Definition**

City of Kirkland SMP Approved by Ecology July 2010

The City of Kirkland states the preference for soft shoreline stabilization over hard in the following regulation:

"If structural stabilization is necessary to protect the primary structure, then the **feasibility of soft structural measures shall be evaluated prior to consideration of hard structural measures. Soft structural stabilization measures must be used unless the City determines that it is not feasible** based on information required in this section and provided by the applicant" [Kirkland Zoning Code 83.300.1(c)].

The City of Kirkland's SMP gives fairly specific definitions for soft shoreline stabilization and bioengineering focusing on potential materials and functional outcomes:

"**Soft Structural Shoreline Stabilization Measures – Shore erosion control and restoration practices that contribute to restoration, protection or enhancement of shoreline ecological functions**. Soft shoreline stabilization **typically includes a mix of gravels, cobbles, boulders, logs and native vegetation** placed to provide shore stability **in a nonlinear, sloping arrangement**" [Kirkland Zoning Code 83.80.120].

"**Bioengineering** – Project designs or construction methods that **use live woody vegetation or a combination of live woody vegetation and** specially developed **natural or synthetic materials** to establish a complex root grid within the existing bank **that is resistant to erosion, provides bank stability, and maintains a healthy riparian environment with habitat features important to fish life**. Use of **wood** structures **or limited use of clean angular rock**

**may be allowable** to provide stability for establishment of the vegetation" [Kirkland Zoning Code 83.80.9].

The updated SMP also gives specific criteria in several provisions for how stabilization projects are to achieve erosion protection and no net loss of ecological function, including specific reference to fish and wildlife habitat:

"...The sizing and placement of all materials shall be selected to accomplish the following objectives:

1) **Protect the property and structures from erosion** and other damage over the long term, and accommodate the normal amount of alteration from wind- and boat-driven waves;

2) **Allow safe passage and migration of fish and wildlife**; and

3) **Minimize or eliminate juvenile salmon predator habitat**" [Kirkland Zoning Code 83.300.8(b)].

The updated SMP also outlines specific design standards for soft structural stabilization. These standards include mention of specific ecological functions such as shallow-water habitat and vegetation:

"**Size and arrange** any gravels, cobbles, logs, and boulders so that the **improvement remains stable** in the long-term, prevents upland erosion, dissipates wave energy, **without presenting extended linear faces to oncoming waves**, and **minimizes impact to assure no net loss of ecological function**" [Kirkland Zoning Code 83.300.13(b)].

"For new and enlarged hard or soft shoreline stabilization, the following additional measures shall be incorporated into the design:

1) To **increase shallow-water habitat**, install gravel/cobble beach fill waterward of the OHWM, grading slope to a maximum of one (1) vertical (v): four (4) horizontal (h). The material shall be sized and placed to remain stable and accommodate alteration from wind- and boat-driven waves" [Kirkland Zoning Code 83.300.10(e)].

A thorough list of vegetation provisions and standards for new stabilization, including soft, is given in Kirkland Zoning Code 83.300.10(e)(2).

Expectations of applicants are clearly stated within Kirkland's SMP. This clarity is intended to result in quicker review and fewer questions and additional requests through the City's review. This will save permit applicants and the City time and money and lead to an effective, efficient implementation of the SMP.

The City also included two code plates [Kirkland Zoning Code 180 Plates 43A & 43B] that provide a soft shoreline stabilization decision tree that outlines and defines potential soft options

based on shoreline physical conditions. The plates further describe what types of stabilization techniques may be considered soft within the City of Kirkland, and outline the scope of options permit applicants are expected to consider. For a further discussion of Plates 43A&B, please see the City of Kirkland Example within the Using Resources for Success section of this document. Plates 43A&B are also provided in Appendix C.

According to the City of Kirkland, the soft shoreline stabilization definition in Kirkland's updated SMP has had some success. For example, Kirkland received a proposal for a "soft" stabilization design that involved lining up logs parallel to the shoreline in a design that would have functioned as hard stabilization. Kirkland was able to successfully implement their SMP resulting in a redesigned stabilization plan that met the City's definition of a soft shoreline. The regulatory standards for soft shoreline stabilization have also been considered successful. Three projects that replaced hard with soft stabilization that met Kirkland's soft standards have been permitted to date.

In summary, the City of Kirkland put a significant amount of effort and resources into developing specific definitions and standards related to soft shoreline stabilization. This was done in an attempt to increase permitting efficiency and soft shoreline implementation success. Kirkland has little variation in shoreline conditions, which makes a specific approach feasible.

**Key Point: The level of specificity for soft shoreline criteria will vary between jurisdictions and will depend upon available data, resources, and characteristics specific to each jurisdiction.**

## Formal Administrative Interpretation

Implementation of soft shoreline stabilization provisions within updated SMPs may need to be further clarified through a formal administrative interpretation. Each updated SMP provides authority to allow local jurisdictions to create an administrative interpretation to clarify SMP development regulations. This process requires consultation with the Department of Ecology to "*insure that any formal written interpretation is consistent with the purpose and intent of chapter 90.58 RCW and the applicable guidelines*" [WAC 173-26-140]. This provides the opportunity for local jurisdictions to interpret their provisions and definitions related to soft shoreline stabilization within their updated SMP as more data analysis and guidance becomes available. This may help identify ways to improve implementation. This option may allow a jurisdiction to consider current science and updated guidance before the 8 year review deadline. It is important to note, however, that an administrative code interpretation cannot change the substantive requirements of the SMP.

There are a few recent and upcoming projects related to soft shoreline stabilization criteria (including this guidance) that jurisdictions may wish to utilize when planning and implementing soft shoreline stabilization. Administrative interpretations that include the use of specific guidance products may be a useful avenue to provide local jurisdictions with a way to use

evolving guidance during SMP implementation. The following are brief descriptions of two projects that have the potential to be very relevant to local jurisdiction soft shoreline SMP implementation: Marine Shorelines Design Guidance and Green Shores for Homes®.

### Marine Shorelines Design Guidelines

WDFW has developed Marine Shorelines Design Guidelines for Puget Sound with funding from the Puget Sound Marine and Nearshore Protection and Restoration Grant Program. This document was published by the Aquatic Habitat Guidelines committee, a WDFW based, inter-agency group. This guidance provides technical design standards for a range of shoreline stabilization techniques including beach nourishment, large wood, bank reslope and revegetation, bulkhead removal, rock revetments, and vertical bulkheads. This material includes case studies, design drawings, and examines the conditions favorable to each of the various stabilization techniques. This guidance can be used as a tool to help facilitate better decisions by local jurisdictions about the siting, design, and permitting of soft shoreline stabilization projects.

Document Reference: Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. J. Barnard, R. Carman, and H. Shipman. 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington.

This guidance is available online at WDFW's website at:
http://wdfw.wa.gov/conservation/habitat/planning/ahg/

### Green Shores for Homes

Green Shores for Homes® is a credit system program developed by the City of Seattle, San Juan County, and Island Trust Canada in coordination with Washington Sea Grant. The Green Shores for Homes® program is a voluntary rating system where shoreline properties can be rated and certified based on a set of environmentally friendly practices and structures, similar to LEED standards for green buildings. The credits were created from an interdisciplinary technical team of shoreline experts. The credit system has several categories including shoreline processes, shoreline habitats, water quality, and shore stewardship. The shoreline processes category includes stabilization related sub-categories such as bulkhead removal, groin/beach structure removal, and shore protection and enhancement. There are also sub-categories under shoreline habitats that include large woody debris and riparian vegetation. The number of available credits for each category and sub-category vary, and are awarded based on the extent of the action. For example, projects that employ soft shoreline stabilization measures over 75-100% of the shoreline receive 5 points, while projects that employ soft stabilization measures over 50-74% over the shoreline receive 3 points.

The program has been developed for both the marine (Puget Sound) and freshwater (Lake Washington) environments. As a part of this project, a map will be available for Lake Washington jurisdictions which categorizes the shoreline based on how amenable it is to

different types of soft stabilization. For more information, see Jurisdiction Example: City of Seattle Lake Washington Wind and Wave Mapping.

The credit system is currently in a pilot form. The use of a third party to evaluate the shoreline projects to determine the total number of credits a project receives is planned. The City of Seattle anticipates using a finalized version of the credit system to assist in determining if a shoreline stabilization project will qualify as soft. Other Puget Sound local jurisdictions may also wish to use this Green Shores for Homes® resource to consult when determining what qualifies as a soft shoreline within their jurisdiction. Jurisdictions may wish to use specific standards suggested in the credit guide, or adopt the credit system in part or in whole as an element of meeting SMP soft shoreline stabilization permit requirements. The potential applicability of this credit system will likely vary between jurisdictions.

For more information on the Green Shores for Homes® project, contact:
Nicole Faghin, Washington Sea Grant at Faghin@uw.edu, (206) 685-8286, or
Maggie Glowacki, City of Seattle at Margaret.Glowacki@seattle.gov, (206) 386-4036.

**Key Point: Jurisdictions implementing updated SMPs may wish to utilize the formal administrative interpretation process to integrate new data and guidance to facilitate management of shoreline stabilization provisions.**

## Using Resources for Success

Soft shoreline stabilization definition and implementation is in a relatively early phase. Therefore, strategies that target, enforce, and encourage soft shorelines in lower risk/higher benefit areas where the techniques are likely to succeed will help provide positive momentum for future projects in areas where success may not be as predictable. The purpose of this section is to provide examples of resources that were developed to help implement successful soft shorelines.

Project "success" is a subjective variable that depends on a stakeholder's perspective. For example, project success from a property owner's perspective may focus on shoreline erosion control and maintenance costs. However, from a public interest perspective success might be characterized by habitat/physical processes enhancements. Recognizing different perspectives on project success is important when developing a soft shoreline implementation strategy and equally as important when evaluating the effectiveness of management efforts throughout implementation of a SMP.

Information regarding soft shoreline stabilization risk, feasibility, benefits to ecological processes and functions, and other related soft shoreline stabilization factors may be useful when targeting shoreline reaches that have the potential to support successful soft shoreline projects.

Jurisdictions may find the Shoreline Inventory and Characterization Reports and Restoration Plans helpful resources in identifying areas where soft shoreline stabilization may or may not be successful. Such resources may include information on development setback, shoreline condition, restoration potential, critical habitats, drift cell details, etc. Jurisdictions are also encouraged to use additional resources that may not have been included in the initial Shoreline Inventory and Characterization Reports and Restoration Plans to help target areas and design techniques for potential soft shoreline stabilization success.

The following are some examples of specific projects conducted by local jurisdictions and other organizations that provide information which may be useful for targeting, encouraging, and enforcing soft shoreline stabilization. While the results of these studies may not have direct applicability to all shoreline jurisdictions within Puget Sound, jurisdictions may wish to consider how similar studies within their community may benefit the implementation of soft shorelines if resources were to become available in the future.

## Jurisdiction Example: Restoration Feasibility and Prioritization Analysis of Sediment Sources in Kitsap County

As a part of the Kitsap Regional Shoreline Restoration Project grant awarded to Kitsap County from the US EPA, sediment source mapping and shoreline restoration/protection prioritization were conducted for Kitsap County. Nearshore sediment sources (both armored and unarmored) were mapped, categorized, and rated for potential sediment contribution. Drift cells and shoreline reaches were prioritized for restoration or protection based on the sediment source ratings and a preliminary existing development risk analysis. In addition, landowner outreach was conducted in areas within priority drift cells and reaches to garner participation interest in a voluntary shoreline armoring removal program.

A matrix was created to demonstrate a risk-based approach to determining feasibility for restoration and the use of restoration and soft stabilization alternatives. This matrix uses an approach which characterizes shoreline sites as either a High or Low rate of erosion and a High or Low risk to development. This matrix is replicated in Table 5. The matrix provides an example of how site specific features can influence targeting efforts for shoreline restoration and soft shoreline stabilization implementation.

The results of this project have been, and will continue to be, valuable in supporting Kitsap County's shoreline management efforts. To date, two single-family residence shoreline properties have participated in the voluntary shoreline armoring removal program. The grant will also be used to support vegetation enhancements and other voluntary shoreline alternatives. Information within this study can be used to evaluate shoreline stabilization permit requests. The information could be utilized to inform soft shoreline stabilization feasibility, risk, and priority which are important for achieving successful soft shoreline stabilization implementation.

**Table 5: Risk-based approach to determining appropriate restoration strategies.**

| | Low Risk to Structures | High Risk to Structures |
|---|---|---|
| Low Rate of Erosion<br>• No evidence of recent erosion<br>• Low bank<br>• Consolidated geologic unit | Opportunity to fully restore shoreline including:<br>• Armor removal<br>• Riparian and backshore vegetation<br>• Beach and upper intertidal substrate | Opportunity for bulkhead alternatives and/or slope restoration, including:<br>• Maximize shoreline restoration of beach substrate and vegetation<br>• Consider use of logs (anchored if necessary) or similar features to stabilize slopes immediately below structures.<br>Additional analysis of risk to structures and flooding risk is necessary |
| High Rate of Erosion<br>• Evidence of past erosion<br>• High bank<br>• Unconsolidated geologic unit | Greatest potential as sediment source, therefore opportunity to fully restore shoreline including:<br>• Armor removal<br>• Riparian and backshore vegetation<br>• Beach and upper intertidal substrate<br>Necessarily analyze the mechanism(s) of failure (i.e., midbank at geologic contact or toe of slope) and current rates of erosion | Highest risk situation with limited opportunities if structures are present. Likely limited opportunity for bulkhead alternatives and/or slope restoration, possibly including:<br>• Restore vegetation on slopes<br>• Consider softshore armoring of toe<br>• Manage stormwater appropriately |

Adapted from Gerstel, et al. 2012. Restoration Feasibility and Prioritization Analysis of Sediment Sources in Kitsap County (Deliverable under Contract KC-390-11).

The full report, including interactive maps, is available on the Kitsap County's Community Development website: http://www.kitsapgov.com/dcd/KCRSRP/kcrsrp.htm#Kitsap_County_Sediment_Source_Analysis_And_Restoration_Prioritization_Study.

For questions regarding this study, please contact Kathlene Barnhart, Kitsap County Department of Community Development at (360) 337-5777.

## Jurisdiction Example: City of Kirkland Soft Shoreline Decision Tree

The City of Kirkland's shorelines are mostly bulkheaded, and future permit requests are anticipated to be mainly for bulkhead repairs and stabilization replacements. Therefore, Kirkland wanted to proactively develop a set of feasible options for soft shoreline stabilization projects to replace hard stabilization based on specific shoreline conditions. The City contracted with a consultant to conduct an analysis of Kirkland's shorelines and develop a decision tree to identify the preferred soft shoreline stabilization option based on key site characteristics. The resulting decision tree is based on consideration of the following site specific factors to characterize the existing shoreline conditions:

- shoreline setback
- bulkhead height
- depth at bulkhead
- nearshore slope
- yard slope

Thresholds are given for each shoreline condition and typical options for soft shoreline stabilization are given for each decision outcome. The typical soft stabilization options are listed and defined in order of preference. These soft options are:

- full beach
- beach cove
- hard stabilization pullback
- slope bioengineering
- hard stabilization enhancement
- nearshore gradient improvement

Two decision trees were created and incorporated into Kirkland Zoning Code Plates 43A (for a 10' to 30' building shoreline setback) and 43B (for a greater than 30' building shoreline setback). A property containing a building with less than a 10' shoreline setback is not required to consider soft shoreline stabilization. The use of these decision trees is required to conduct a feasibility study for new, enlarged, and replacement hard and soft stabilization permits.

The decision tree provides criteria for what may qualify as soft stabilization under the Kirkland Zoning Code based upon a specific set of shoreline conditions. The decision tree clearly presents options and the feasibility of those options to permit applicants with the intention of saving permit applicants time and money. The decision tree also has the potential to increase applicant confidence that soft stabilization techniques will be successful. The required use of the decision tree in permit applications is intended to result in successful, appropriate soft shoreline stabilization projects through SMP implementation.

Kirkland Zoning Code Plates 43A&B are provided in Appendix C and can also be found in Kirkland Zoning Code Chapter 180 at the website: http://www.codepublishing.com/wa/kirkland/

For more information on Kirkland's decision tree, contact:
Teresa Swan, Senior Planner City of Kirkland at tswan@kirklandwa.gov, (425) 587-3258, or
Dan Nickel, The Watershed Company at DNickel@watershedco.com, (425) 822-5242.

While the City of Kirkland's use of a decision tree is an excellent example, it is important to acknowledge that the complexities of marine shorelines, in particular larger county jurisdictions, may not allow for a jurisdiction wide decision tree. This limitation is largely due to the lack of detailed (site specific) information available to jurisdictions managing larger segments of shoreline areas. Therefore, it is not suggested that jurisdictions which lack detailed data on site conditions attempt to follow Kirkland's approach, as over simplification of shoreline conditions may result in projects that are either undesirable or unsuccessful.

## Jurisdiction Example: City of Seattle Lake Washington Wind and Wave Modeling

The City of Seattle, with funding from the US EPA's Puget Sound Watershed Management Assistance Program, is currently conducting a wind and wave mapping project for Lake Washington as part of the Green Shores for Homes® grant project. The scope of work includes two phases. Phase 1 will model wave growth and propagation to the shoreline. Wave energy will be calculated and classified at distances from the shoreline prior to waves interacting with the nearshore slope and shoreline structures. Phase 2 will classify the wave energy levels impacting the shoreline. Phase 2 will focus on wave energy transformation on the nearshore slope and interaction with shoreline structures and features. Phase 2 also includes developing qualitative information on sediment transport at major littoral cells of the lake. This project will evaluate wave energy derived from both wind and vessel wakes. One of the project results will be a map that categorizes the shoreline with information from the wave energy and sediment transport results. The information from this project will be available to the local jurisdictions surrounding Lake Washington to aid them in determining feasibility for soft shoreline options.

For more information please contact Maggie Glowacki, City of Seattle Department of Planning and Development at Margaret.Glowacki@seattle.gov or (206) 386-4036.

## Puget Sound Example: Feeder Bluff Mapping

The Department of Ecology received funding from the Marine and Nearshore Protection and Restoration Grant program to complete mapping of feeder bluffs throughout Puget Sound. This project will provide maps of feeder bluffs and other coastal landforms available online in the Washington Coastal Atlas, a technical report on the significance and distribution of feeder bluffs, and guidance on how to apply this information to management objectives. This guidance will help local governments identify sensitive shorelines, improve policies for managing erosion and shoreline armoring, and evaluate the feasibility and appropriateness of soft shoreline stabilization

methods. Local jurisdictions may wish to use this information to make decisions relevant to soft shoreline stabilization feasibility and success.

For further information on the Feeder Bluff Mapping project, contact Hugh Shipman, ECY at hshi461@ecy.wa.gov or (425) 649-7095. Information for this project will be available at the Shorelands and Environmental Assistance website.

**Key Point: Jurisdictions are encouraged to pursue and use additional resources and analyses to create strategies that target, enforce, and encourage soft shorelines in lower risk/higher benefit areas.**

# Part IV: Permitting Soft Shoreline Stabilization

Main sections included in Part IV:

- Shoreline Modification Principles
- Demonstration of Need and Soft Shorelines
- New vs. Replacement Stabilization
- Evaluating Soft Shoreline Stabilization

The SMP Guidelines are fairly prescriptive when it comes to writing the shoreline stabilization section for updated SMPs [WAC 173-26-231(3)(a)]. However, the successful administration of soft shoreline stabilization regulations remains a challenging task. Permit reviews can be overwhelming; they can be time consuming and often raise a variety of site specific questions and concerns. However, consideration of a number of factors included in this guidance will help ensure consistent and effective administration of soft shoreline stabilization. The purpose of this section is to provide guidance on topics relevant to soft shoreline stabilization permit review. This includes discussions of the SMP Guideline shoreline modification principles, demonstration of need for stabilization, feasibility of soft shoreline alternatives, regulatory differences in reviewing new vs. replacement stabilization proposals, and evaluation of key soft project elements.

## Shoreline Modification Principles

Authorization of shoreline modifications (i.e., stabilization, docks, dredging…etc.) needs to be consistent with the principles listed in WAC 173-26-231(2). These principles are intended to only allow necessary shoreline modifications while avoiding or minimizing ecological impacts, thus resulting in no net loss of ecological function. Soft shoreline stabilization projects are shoreline modifications, and therefore must adhere to the principles for demonstrating need and limiting environmental impact before such projects are permitted. The following is a list of shoreline modification principles given in WAC 173-26-231(2). Bolded emphasis has been added to the language to highlight key parts of the principles:

(a) "**Allow** structural shoreline modifications **only where they are demonstrated to be necessary** to support or protect an allowed primary structure or a legally existing shoreline use that is in danger of loss or substantial damage..."

(b) "**Reduce the adverse effects** of shoreline modifications and, as much as possible, **limit** shoreline modifications **in number and extent**…"

(c) "**Allow only** shoreline **modifications** that are **appropriate to the specific type of shoreline and environmental conditions** for which they are proposed."

(d) "**Assure** that shoreline **modifications individually and cumulatively do not result in a net loss of ecological functions**. This is to be achieved by **giving preference to** those types of shoreline modifications that have **a lesser impact on ecological functions**..."

(e) "Where applicable, **base provisions on scientific and technical information and a comprehensive analysis of drift cells for marine waters**..."

(f) "**Plan** for the **enhancement of impaired ecological functions** where feasible and appropriate **while accommodating permitted uses**. As shoreline modifications occur, **incorporate all feasible measures to protect ecological shoreline functions and ecosystem-wide processes**."

(g) "**Avoid and reduce significant ecological impacts** according to the mitigation sequence in WAC 173-26-201(2)(e)."

These shoreline modification principles set the stage for administration of shoreline modification permits, including soft shoreline stabilization permits. It is important to remember that the construction and site level disruption associated with soft shoreline stabilization rarely results in a "no impact" modification. In the long-term soft shoreline stabilization is intended to either maintain or enhance ecological functions and *avoid* or at least *minimize* negative environmental impacts to the nearshore zone. However, soft stabilization activities will still likely result in some degree of short or long-term impacts to nearshore ecological function. Therefore, soft stabilization projects must also satisfy the following:

- **Justified:** demonstrated to be necessary to protect a primary structure or use
- **Minimize:** the stabilization design shall be limited in size and extent to ensure that the modification is the absolute minimum needed to serve its intended purpose
- **Designed for Site:** incorporate appropriate design elements consistent with specific shoreline conditions
- **No Net Loss:** ensure that the design and construction of the proposal does not result in a net loss of ecological functions.

Demonstration of the need for soft shoreline stabilization and the evaluation of how projects are appropriate to specific shoreline conditions and influencing no net loss are among the most important factors to consider when reviewing soft shoreline stabilization permit applications. Proper consideration of these factors will greatly contribute to successful implementation of the shoreline modification principles.

**Key Point: Soft shoreline stabilization must adhere to the shoreline modification principles in the SMP Guidelines and local SMP.**

## "Demonstration of Need" and Soft Shorelines

The required "demonstration of need" standard for shoreline stabilization modifications is one of the most important, yet one of the most difficult, shoreline modification principles to implement. Confidently evaluating demonstrated need from permit applications and geotechnical reports can be challenging, particularly for local jurisdictions that may not have supplementary resources such as a licensed geotechnical expert to help interpret site specific risk factors. Additional guidance for the demonstration of need requirement will continue to be developed. The guidance provided in this section will focus on the *concept* of demonstration of need and feasibility as it relates to implementation of soft shoreline stabilization preferences consistent with applicable SMP Guidelines policy.

A good understanding of demonstration of need is very important in determining appropriate management actions in cases of shoreline erosion risk to primary structures and uses. It is also a basis for determining the feasibility of new, expanded, or replacement stabilization techniques at a particular site. Figure 5 represents how erosion, risk, stabilization, demonstration of need, and demonstration of feasibility are related. A diagram adapted from WDFW's publication "Protecting Nearshore Habitat and Functions in Puget Sound" (2007) in Figure 6 shows stabilization permit review steps as a way to characterize the importance of demonstration of need. More comprehensive guidance on shoreline stabilization demonstration of need is in progress and will be available in Ecology's SMP Handbook.

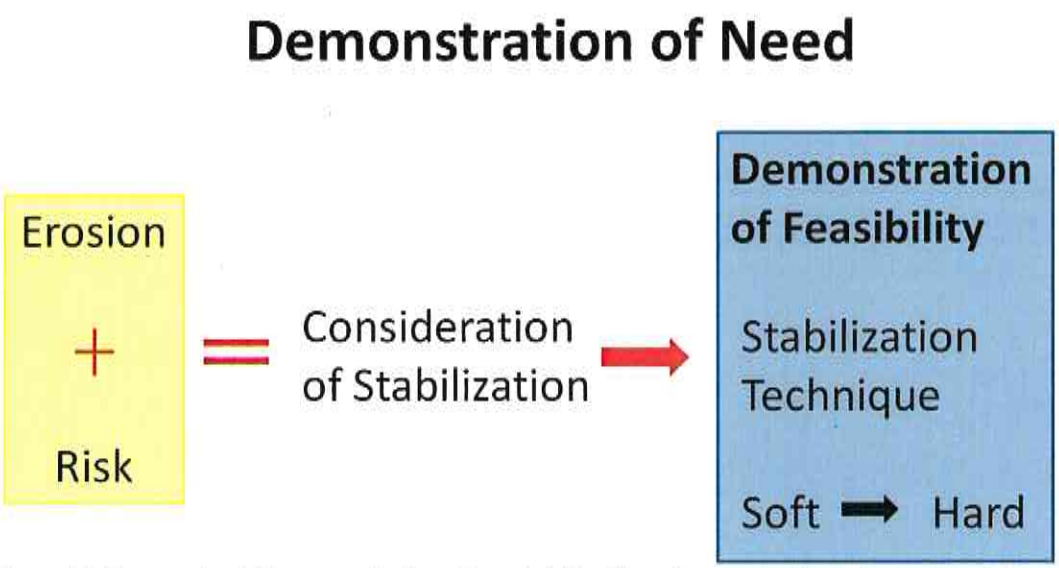


**Figure 5: Conceptual diagram of shoreline stabilization demonstration of need and feasibility.** Erosion and risk are both required before consideration of shoreline stabilization. Once consideration of shoreline stabilization is justified, demonstration of feasibility is needed to determine which stabilization technique will be implemented. Soft techniques should be considered over hard techniques. Demonstration of feasibility is an important part of demonstration of need.

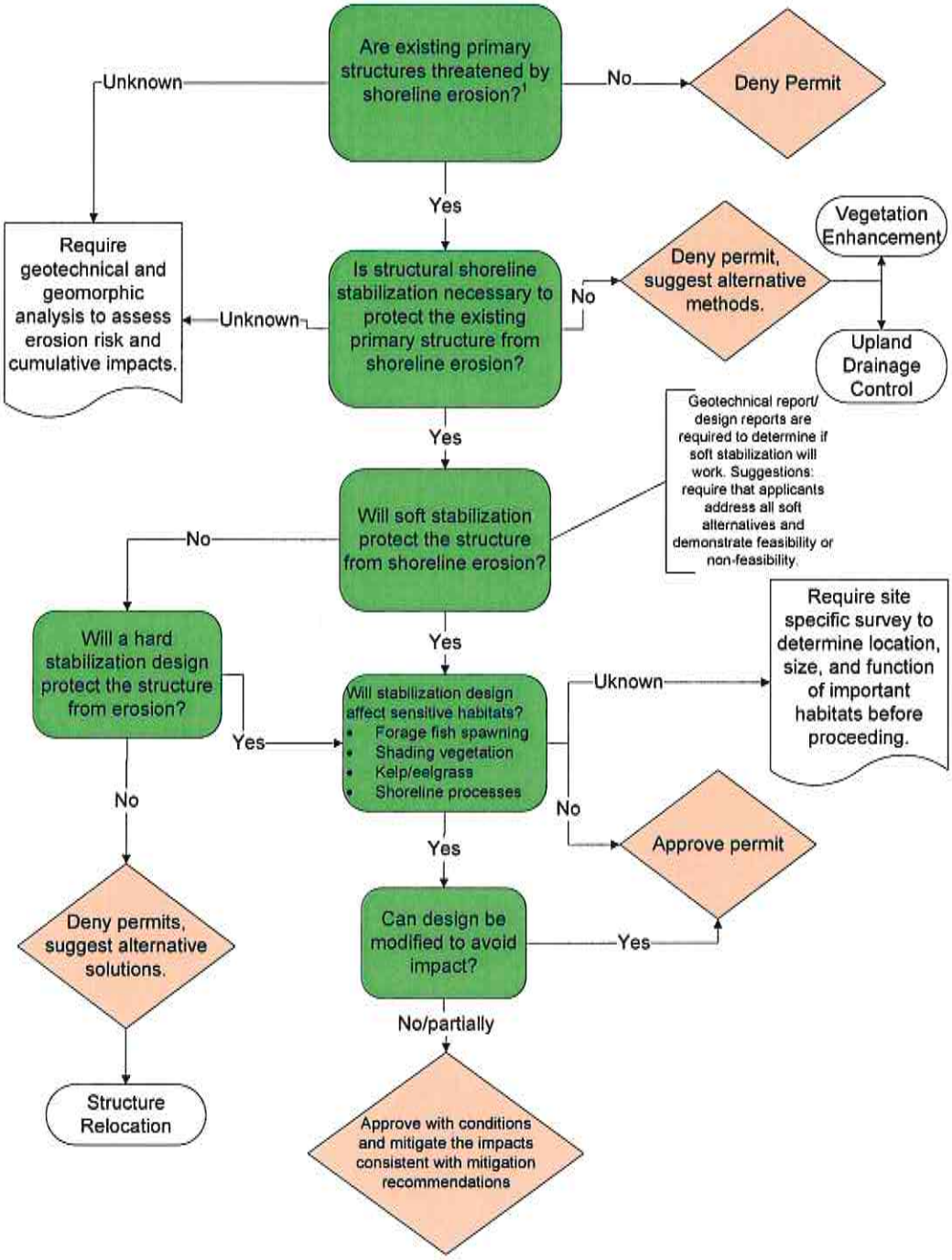


**Figure 6: Steps for reviewing shoreline stabilization permits.**

Adapted and modified from EnviroVision et al. 2007, revised 2010. Protecting Nearshore Habitat and Functions in Puget Sound.

[1]This is an example of permitting for new stabilization structures to protect existing primary structures [WAC 173-26-231(3)(a)(iii)(B)(I)]. Details for other stabilization scenarios may differ, see WAC 173-26-231(3)(a)(iii)(A-F).

## Demonstration of Need for Stabilization

One of the first, yet occasionally overlooked, considerations in reviewing a soft shoreline stabilization permit application is the demonstrated need for stabilization. As discussed in the Shoreline Modification Principles section in this guidance, shoreline modifications including soft shoreline stabilization must be demonstrated to be necessary to support or protect an allowed primary structure or use [WAC 173-26-231(2)(a)]. Therefore, permit applications for soft stabilization must demonstrate a need to protect an existing structure or primary use that is shown to be at risk from erosion (see Figure 6). For example, periodic erosion to a vacant lot would not provide sufficient demonstration of a need to install shoreline stabilization at the site.

The SMP Guidelines standards that address demonstrated need for shoreline stabilization distinguish between new and replacement stabilization. New stabilization projects, including expanded stabilization, require a geotechnical analysis to document applicable factors necessary to justify the need for an action [WAC 173-26-231(3)(a)(iii)(B)(I & II)]. Replacement stabilization simply requires a "*...demonstrated need to protect principal uses or structures from erosion caused by currents, tidal action, or waves*" [WAC 173 26 231(3)(a)(iii)(C)]. For a further discussion of the differences between new and replacement stabilization, see the New vs. Replacement Stabilization section.

The standards discuss the expectations for a geotechnical report as follows:

> "**Geotechnical reports** pursuant to this section that address the need to prevent potential damage to a primary structure **shall address the necessity for shoreline stabilization by estimating time frames and rates of erosion and report on the urgency** associated with the specific situation. As a general matter, **hard armoring solutions should not be authorized except when a report confirms that there is a significant possibility that such a structure will be damaged within three years** as a result of shoreline erosion in the absence of such hard armoring measures, **or where waiting** until the need is that immediate, **would foreclose the opportunity to** use measures that **avoid impacts on ecological functions**." [WAC 173-26-231 (3)(a)(iii)(D)]

The SMP Guidelines also mention the role of geotechnical reports in justifying *soft* shoreline stabilization:

> "Thus, **where the geotechnical report confirms a need** to prevent potential damage to a primary structure, **but the need is not as immediate as the three years, that report may** still be used to **justify** more immediate authorization to protect against erosion **using soft measures**." [WAC 173-26-231(3)(a)(iii)(D)]

Otherwise, the SMP Guidelines are fairly vague as to what constitutes a demonstration of need. During the development of their comprehensive SMP update or through a formal SMP amendment, jurisdictions are encouraged to define and place specific criteria for what is to be included in a geotechnical analysis. This is intended to guide applicants on what information and analyses should be included in the permit application. This will help ensure that appropriate information is available to local jurisdictions for making an informed decision on whether or not a soft shoreline stabilization permit request meets demonstration of need. Some jurisdictions

have also chosen to require a geotechnical analysis for replacement stabilization, even though this is not required in the SMP Guidelines [WAC 173 26 231(3)(a)(iii)(C)].

Local jurisdictions have the authority to place the burden of proof on the applicant to demonstrate need and feasibility. This authority is presented in the WAC under the definition of "feasible":

> "...In cases where these guidelines require certain actions unless they are infeasible, the burden of proving infeasibility is on the applicant" [WAC 173-26-020(15)(c)].

Therefore, the applicant bears the responsibility to provide proof for demonstrating the need for stabilization. The applicant also has the responsibility to demonstrate that non-structural methods, such as vegetation enhancements, drainage control, and relocation of structure(s) are not feasible in order to justify a need for shoreline stabilization. Once a need for shoreline stabilization is justified, the applicant has the burden to demonstrate that soft shoreline stabilization is not feasible in order to justify need for hard shoreline stabilization.

**Key Point: Soft shoreline stabilization may only be permitted when a need can be demonstrated.**

**Key Point: The applicant has the burden of proof to demonstrate stabilization need and soft shoreline stabilization feasibility.**

## Demonstration of Soft Shoreline Stabilization Feasibility

Once demonstrated need for stabilization has been established, the next step is to consider the feasibility of softer alternatives. WAC 173-26-231(3)(a)(iii)(E) states that:

> "Soft approaches shall be used unless demonstrated not to be sufficient to protect primary structures, dwellings, and businesses."

This means that soft shoreline measures must be deemed infeasible before a hard measure can be pursued. This should involve a review of many soft shoreline alternatives, not just one or two.

Assessing the feasibility of soft stabilization methods can be technically challenging for both geotechnical experts and local jurisdictions. In addition, because designs and engineering for traditional hard approaches are widely available and have predictable effectiveness regarding shoreline stabilization, it may be common to see proposals that default to traditional hard approaches. Concerns related to a contractor or consultant's liability to ensure adequate protection of a shoreline residence or personal preferences from a property owner may also play a role. This may result in permit applications and geotechnical reports that are relatively vague as to the feasibility of soft shoreline stabilization alternatives. Planners can address this issue by asking specific questions and require that consultants provide specific answers and quantify their

work. Thorough demonstration of how consultants and contractors arrive at their conclusions is important for permit evaluation.

There are opportunities for local jurisdictions to provide specific requirements for meeting demonstration of need and feasibility. One such opportunity is to provide soft shoreline feasibility requirements within a permit application submittal checklist or the SMP itself. This may be as simple as requiring applicants to address the feasibility of a list of soft shoreline alternatives to ensure that all potential soft measures are considered. Or, as in the case of the City of Kirkland, provide prescriptive feasibility requirements in the form of a decision tree included as regulations in their SMP (see Jurisdiction Example: City of Kirkland Soft Shoreline Decision Tree).

Jurisdictions with the available resources may use the opportunity to contract with a geotechnical expert or licensed engineer to review the demonstration of need and feasibility descriptions provided in the permit applications. Another potential opportunity is to provide resources to applicants for where to find information about their shoreline and list possible sources for who can assist applicants in determining the most appropriate option. For example, upon request the City of Kirkland provides a list of contractors/consultants that have experience installing soft shoreline projects based on information from the City's shoreline consultants, with the caveat that the City does not endorse any particular contractor/consultant. The applicant may also submit the qualifications of other contractors/consultants for City approval. Some jurisdictions, such as Whatcom County, require a pre-application meeting which would begin a back-and-forth communication of feasibility demonstration and expectations.

In summary, clearly explaining soft shoreline feasibility expectations upfront to potential applicants may help them consider soft alternatives to hard structures before approaching a contractor. This may save time and money by focusing resources in assessing the most feasible stabilization option. For examples of specific projects conducted by local jurisdictions and other organizations related to soft shoreline stabilization feasibility, please see Using Resources for Success.

**Key Point: A variety of soft shoreline stabilization measures must be deemed infeasible before a hard stabilization measure can be permitted.**

## New vs. Replacement Stabilization

*Scenarios where soft stabilization is new to a previously unmodified shoreline site or where soft stabilization is expanding an existing stabilization structure are referred to in this guidance as **new** soft shoreline stabilization.

*Scenarios where soft stabilization is replacing current hard stabilization are referred to in this guidance as **replacement** soft shoreline stabilization.

An important consideration when reviewing soft shoreline stabilization permits is whether or not the permit is for new or replacement stabilization. Apart from differences with regard to demonstrating need [WAC 173-26-231(3)(aiii)(B&C)], new and replacement stabilization can have some important differences with regards to prioritizing and evaluating soft shorelines. The differences between evaluating new and replacement structures lie in determining the potential range of feasible alternatives available and anticipating what forms of ecological enhancements can or cannot be integrated into either type of action. Due to these differences, jurisdictions may want to consider utilizing different criteria for what may be considered a soft shoreline between new and replacement stabilization. The purpose of the following sections is to discuss the differences in evaluating new versus replacement soft stabilization projects and some related considerations for prioritizing soft attributes between new and replacement scenarios.

**Key Point: In most cases, soft shoreline review and priorities will differ between new and replacement stabilization projects.**

## New Soft Shoreline Stabilization

### Must Be Justified

There are clear requirements in the SMP Guidelines that must be satisfied before new stabilization structures (including additions to or enlargement of existing structures) will be permitted [WAC 173-26-231(3)(a)(iii)]. This emphasizes the point that new structural shoreline modifications will have some level of impact to shoreline ecological functions and therefore need to be clearly justified as necessary to protect primary structures.

Soft shorelines provide an opportunity for avoiding and minimizing ecological impacts in scenarios where stabilization is needed. However, it is important that these permits are thoroughly reviewed to ensure that impacts are avoided and minimized to the maximum extent feasible. Local jurisdictions have the authority through their updated SMPs to rigorously review permits for new soft shoreline stabilization. Permit staff should use the SMP, restoration plan, additional available resources, and professional judgment to apply high standards for what may be considered soft for new stabilization within their jurisdiction.

### Avoidance and Minimization

In order to ensure no net loss and maintain SMA consistency, all shoreline stabilization proposals should clearly demonstrate how the project *avoids and minimizes* impacts to ecological processes and functions. Priority should be given to soft shoreline attributes (see Attributes of Soft Shoreline Stabilization Projects) that avoid impacts or enhance ecological processes and functions important to the specific jurisdiction and shoreline reach. The following hypothetical examples of new soft shoreline stabilization are intended to illustrate how different priorities can be given to soft attributes based on specific shoreline conditions.

**Example C:**
A local jurisdiction receives a shoreline permit application requesting approval for new soft shoreline stabilization on a shoreline property with no current shoreline modifications. A geotechnical analysis was conducted by a qualified professional on behalf of the applicant that demonstrates a need for stabilization in order to protect the primary residence from natural shoreline erosion. The permit application includes a stabilization design which the applicant claims qualifies as soft shoreline stabilization. This shoreline property is a part of a shoreline reach that has little impairment to shoreline processes and functions. This shoreline is relatively dynamic and characterized as a functioning drift cell transport zone. Based on this information, a soft shoreline stabilization permit should include the following soft attributes to the maximum extent feasible:

- Maintains dynamic features
- Maintains sediment transport to down drift properties
- Avoids erosion on adjacent properties
- Maintains aquatic-terrestrial habitat connectivity
- Maintains or has minimal impacts to backshore habitat
- Uses materials natural to the site

A permit application that includes these soft attributes may be considered a soft stabilization proposal. A proposal that significantly deviates from these soft attributes will either not be considered soft or may not be permitted.

**Example D:**
A local jurisdiction receives a permit application requesting installation of new soft shoreline stabilization on a relatively ecologically intact shoreline property with limited shoreline modifications. A geotechnical analysis was conducted by a qualified professional on behalf of the applicant that demonstrates a need for stabilization in order to protect the primary residence from shoreline erosion exacerbated by surrounding shoreline armoring. The permit application includes a stabilization design which the applicant claims qualifies as soft shoreline stabilization. This shoreline property occurs along a shoreline reach with a significant amount of current hard stabilization. The shoreline site does have intact shoreline vegetation and habitat and is documented to host juvenile salmon. Based on this information, a soft shoreline stabilization permit should include the following soft attributes to the maximum extent feasible:

- Avoids erosion on adjacent properties
- Maintains aquatic-terrestrial habitat connectivity
- Maintains or minimizes impacts to backshore habitat
- Maintains or minimizes impacts to habitat features important for juvenile salmon
- Uses materials natural to the site

A permit application that includes these soft attributes may be considered a soft proposal. A proposal that significantly deviates from these soft attributes will either not be considered soft or may not be permitted.

The main difference between these two hypothetical examples is a physical process priority vs. a habitat and biological process priority. Example C has intact sediment transport processes with dynamic shoreline features while Example D occurs in a shoreline reach where sediment transport and dynamic features are already limited due to current surrounding armoring. Example D has identified habitat for sensitive species, therefore soft attributes that maintain and minimize impact to that habitat are a priority over soft attributes that would do little to enhance the current physical processes.

Local jurisdictions should also consider strategies for setting precedence for new soft shoreline stabilization. Clearly establishing relevant standards for what will be expected in permit applications for new soft shoreline proposals will influence future applicants to pay particular attention to key stabilization design or site specific factors. This will help focus the permit review and ensure SMP compliance.

**Key Point: New stabilization proposals have a higher obligation to justify a need for stabilization. New stabilization projects should employ the softest feasible option with the least environmental impact while still providing the necessary amount of shoreline stabilization.**

## Replacement Soft Shoreline Stabilization

### Soft Shoreline Opportunity

The SMP Guidelines allow jurisdictions to consider proposals to replace an existing stabilization structure, if there is "*...a demonstrated need to protect principle uses or structures from shoreline erosion due to currents, tidal action, or waves*" [WAC 173-26-231(3)(a)(iii)(C)]. While replacements are often thought of as replacing existing structures in-kind with similar structures, the SMP Guidelines require that softer solutions be considered before allowing in-kind replacement.

Soft shoreline replacements provide an opportunity for jurisdictions to achieve incremental improvement of shoreline conditions. Local jurisdictions have the authority through their updated SMPs to clarify local preferences for feasible soft stabilization alternatives in replacement scenarios [WAC 173-26-231(3)(a)(iii)(E)]. Therefore, local jurisdictions should consider how soft shoreline replacements can best be utilized as opportunities for achieving incremental improvement of shoreline ecological processes and functions.

### Incremental Improvement

Evaluation of replacement soft shoreline stabilization permits should focus on how the project results in *incremental improvement* of shoreline ecological processes and functions. This strategy will help jurisdictions successfully implement no net loss and maintain SMA consistency.

Specific prioritization of key stabilization elements necessary to support incremental improvement will vary between site and jurisdiction. As a starting point, jurisdictions are encouraged to use their Shoreline Inventory and Characterization Reports and Restoration Plans to identify key ecological processes, functions, and restoration priorities within their shoreline areas. These priorities can then be used to target specific soft attributes to encourage as part of stabilization replacement proposals or mitigation priorities. For example, a jurisdiction that has recognized a restoration priority for forage fish habitat may want to identify replacement stabilization proposals as an opportunity to encourage soft replacement designs that will enhance forage fish habitat. Jurisdictions are encouraged to track these incremental improvements to document for future review of the SMP, their administration of shoreline stabilization standards, and implementation of restoration goals.

The key difference between new and replacement proposals is that it may not be feasible for soft replacements to achieve the same level of ecological function expectations as new soft stabilization proposals. Each new soft stabilization proposal should be required to demonstrate *avoidance and minimization* of impacts specific to the individual proposal. The results of replacement proposals may vary due to site constraints, for which some proposals may be able to achieve *incremental improvements* as part of the replacement action. Therefore, the criteria and expectations for soft shoreline stabilization will not be the same for considering new and replacement proposals. It is, however, reasonable to hold soft replacement projects to a higher standard for ecological enhancement if there is public funding contributing to the project.

These differences may have important regulatory implications for soft stabilization permits, particularly within jurisdictions that choose to have different permit requirements between hard and soft stabilization (Substantial Development Permit, Conditional Use Permit, exemptions, or prohibitions). Jurisdictions should consider this when setting and implementing soft shoreline definitions and criteria.

### Replacement Constraints

Surrounding conditions in replacement scenarios (highly modified and armored shorelines), will strongly influence the feasibility and extent of using soft shoreline techniques to replace an existing hard structure. Lot size, location of structures, potential effects to adjacent properties, sediment supply within the drift cell, and presence of historical fill are just some of the constraints commonly associated with replacement scenarios along higher density shoreline areas. However, some incremental enhancement opportunities may still exist in the form of vegetation enhancement, moving a structure landward, fill removal, or regrading the shoreline as part of a replacement project.

The constraints influencing the feasibility of soft shoreline techniques may result in soft shoreline projects that lean toward the harder end of the shoreline scale (see Shoreline Stabilization Continuum). The ability and extent of these "harder" soft techniques to incrementally improve priority shoreline processes, functions, and habitat should be considered by each jurisdiction. Figure 7 visually expresses three replacement stabilization scenarios that demonstrate the importance of sufficient incremental improvement for a soft shoreline.

**Key Point: Replacement of existing armoring with soft shoreline stabilization provides an opportunity for incremental improvements to shoreline functions.**

**Figure 7: Visualization of incremental improvement.**
This is a rendering of possible replacement stabilization options for a shoreline property with an existing bulkhead. Option D represents a replacement option where soft techniques are utilized sufficiently to achieve appropriate incremental improvement for the site.
A. Existing hard armoring
B. Replacing the bulkhead in kind with vegetation enhancement is not enough to be considered soft. This option does not have key possible soft attributes such as lowered gradient, biological connectivity, and soft substrates.
C. Replacing the bulkhead with a sloping revetment with vegetation is still not enough to be considered a soft shoreline in this scenario. While the gradient is lowered, biological connectivity is still greatly impaired and soft, natural substrates are absent.
D. Replacing the bulkhead with feasible soft techniques including multiple soft attributes results in a soft shoreline. Some key soft attributes of this project are: low gradient, soft substrates, and biologic connectivity.
(Kelsey Gianou photo.)

# Evaluating Soft Shoreline Stabilization Proposals

When reviewing soft shoreline stabilization permits, evaluating whether or not a proposed stabilization design truly meets the intent of soft shoreline stabilization is important. As described in the Shoreline Stabilization Continuum section of this guidance, there is a range of possibilities for shoreline stabilization, some with more soft features than others. The goal of evaluating shoreline stabilization designs is to permit the "softest" feasible option that balances the demonstrated need for stabilization. In some cases, feasibility restrictions may result in hybrid or hard stabilization requirements, and it is important that these permits are recognized as such, and not mislabeled as soft. This will help achieve consistent and efficient administration of updated SMPs.

Evaluating soft shoreline stabilization proposals can determine if the proposed design meets any specific soft shoreline stabilization criteria or priority attributes defined by the local jurisdiction. Jurisdictions that have proactively prioritized soft shoreline attributes (see Attributes of Soft Shoreline Stabilization Projects) within their jurisdiction may have an advantage in determining whether or not a soft proposal meets the soft shoreline intent and qualifies as soft. Jurisdictions with limited criteria for soft shorelines will still benefit from evaluating the presence of soft attributes within stabilization permit applications to determine if the proposal will impair, maintain, or enhance ecological functions.

It can be difficult to evaluate a proposed soft shoreline. Permit staff should consider any soft shoreline stabilization definitions provided by their jurisdiction, as well as site specific characteristics that will influence appropriate soft attributes. Permit staff may also wish to consider the following generalized question:

### Will the proposed soft stabilization permit maintain and/or enhance ecological processes and functions?

The use of the terms "maintain" and "enhance" generally refer to new and replacement stabilization projects, respectively. Ideally, soft shoreline stabilization for new structures will aim to *maintain* shoreline ecological processes and functions to the maximum extent possible. Soft shoreline stabilization for replacement structures will ideally aim to *enhance* shoreline ecological processes and functions to the maximum extent possible. For a further discussion of the differences between new and replacement soft stabilization, please see the New vs. Replacement Stabilization section in this guidance.

Admittedly, the general question: *Will the proposed soft stabilization permit maintain and/or enhance ecological processes and functions?* is very difficult to answer during a permit evaluation. However, proxy questions may be used to help answer this ecological function question by identifying which soft attributes may be included within a proposed stabilization permit. To assist permit staff in evaluating soft shoreline stabilization permits, this guidance presents a set of proxy questions that aim to identify soft shoreline attributes and potential benefits or impacts to shoreline ecological process and functions. The proxy questions to use when evaluating a soft shoreline stabilization permit are categorized as:

- Physical Processes
- Habitat/Biological Processes
- Intertidal Habitat
- Materials/Methods

These proxy questions are not mutually exclusive and some overlap of identified features and processes may occur. The intent is to provide recommended proxy questions that approach the evaluation from multiple angles to determine if proposed stabilization features may impact, maintain, or enhance ecological processes and habitats.

**Key Point: It is important to evaluate soft shoreline stabilization proposals to determine if they meet the intent of soft shoreline stabilization.**

## Physical Processes

The Puget Sound Nearshore Ecosystem and Restoration Project (PNSERP) has identified that natural physical shoreline processes are crucial for Puget Sound nearshore health (Johannessen & MacLennan, 2007). The following are recommended proxy questions to consider when evaluating if a soft shoreline stabilization project will benefit or adversely impact physical shoreline processes.

Will the stabilization project…

- **impound sediment and prevent significant sources of sediment from entering the drift cell?**
  Stabilization projects can prevent significant sources of eroding sediment from reaching the beach. This will be particularly true on eroding bluffs (feeder bluffs) that contribute to the overall sediment supply of a drift cell. This in turn may starve down-drift beaches, causing erosion on transport or accretion beaches (Williams & Thom, 2001; Johannessen & MacLennan, 2007). Not only does this cause a problem for erosion on down-drift properties, but also may decrease spawning habitat for forage fish (Thom et al. 1994). **Stabilization projects that allow or restore natural sediment delivery have a soft shoreline attribute.**

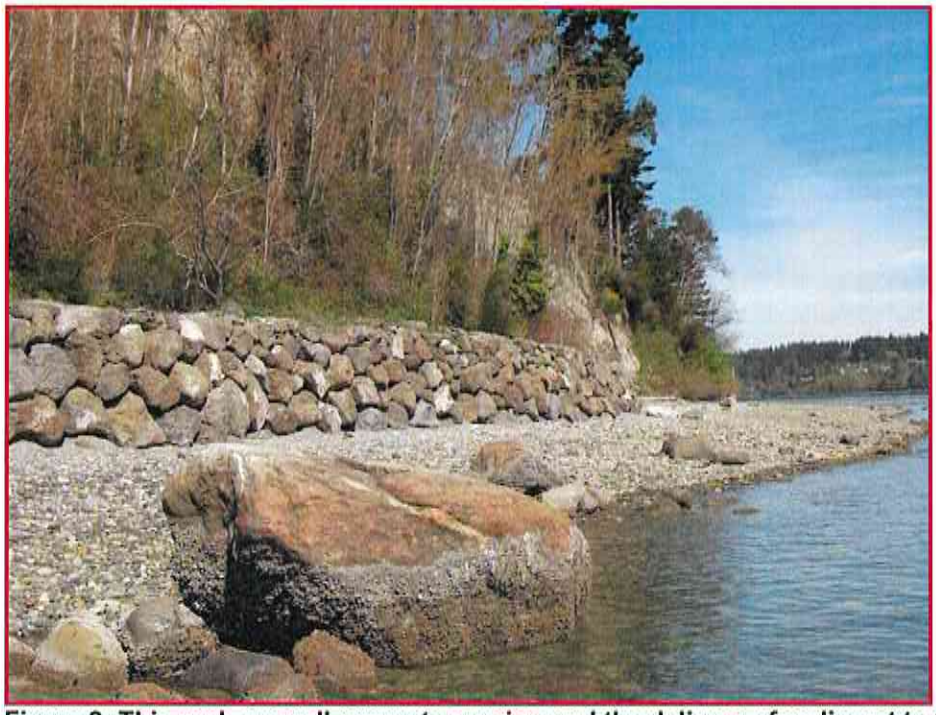

**Figure 8: This rock seawall prevents erosion and the delivery of sediment to the beach.** (Hugh Shipman photo.)

- **maintain/enhance sediment drift?**
  Some stabilization techniques such as groins and other structures that protrude into active transport zones of a beach can inhibit sediment from traveling through a drift cell. This can increase erosion on down-drift beaches (Johannessen & MacLennan, 2007). **Stabilization projects that maintain or enhance sediment transport within a drift cell have a soft shoreline attribute.**

  It is important to consider, however, that many soft shoreline stabilization projects, particularly beach nourishment, utilize groins to provide stability to the nourished beach. While groins may be used as a structural component that contributes to the success of a soft project, they should not significantly inhibit or alter sediment transport within the drift cell.

**Figure 9: This riprap groin is preventing sediment from travelling along the beach.** (Hugh Shipman photo.)

- **maintain/enhance accretion and/or erosion cycles?**
  Accretion beaches such as barrier beaches or spits often have accretion and erosion cycles. Hard armoring is often non-dynamic or non-flexible and can affect the natural accretion and erosion cycles on accretion beaches. Stabilization projects that have softer, more flexible elements may respond more dynamically to storms, absorbing wave impact and allowing the shoreline to naturally adapt. This may result in a slight shoreline morphology change and short term erosion, but may continue the long term accretion features of the beach. **Stabilization projects that have naturally dynamic and flexible features have a soft shoreline attribute.**

**Figure 10: This seawall and riprap on a spit does not allow for natural accretion and erosion cycles of the beach.**
(Hugh Shipman photo.)

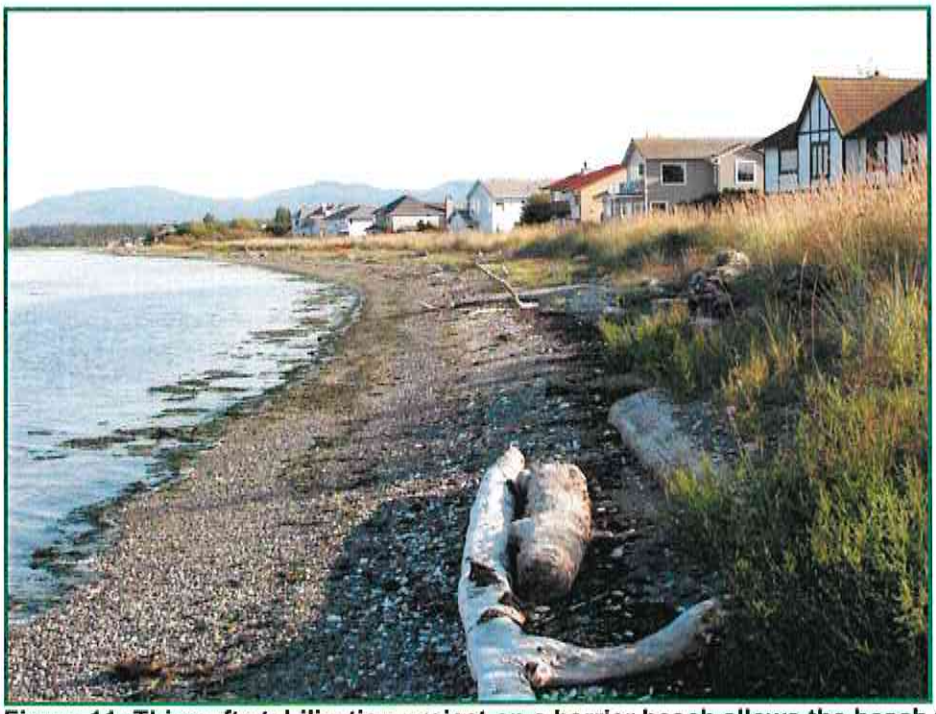

**Figure 11: This soft stabilization project on a barrier beach allows the beach to respond to natural erosion and accretion cycles.**
(Hugh Shipman photo.)

- **minimize effects on adjacent properties?**
  Stabilization projects that employ hard structural elements such as bulkheads, seawalls, and riprap can increase wave refraction on adjacent shorelines (Shipman, 2010). Hard structures that increase erosion on adjacent and down drift properties can facilitate the desire and need for stabilization structures on these other properties, creating a domino-type effect of shoreline armoring (Roberts, 2010). **Stabilization projects that increase erosion on adjacent properties should not be considered soft shorelines.**

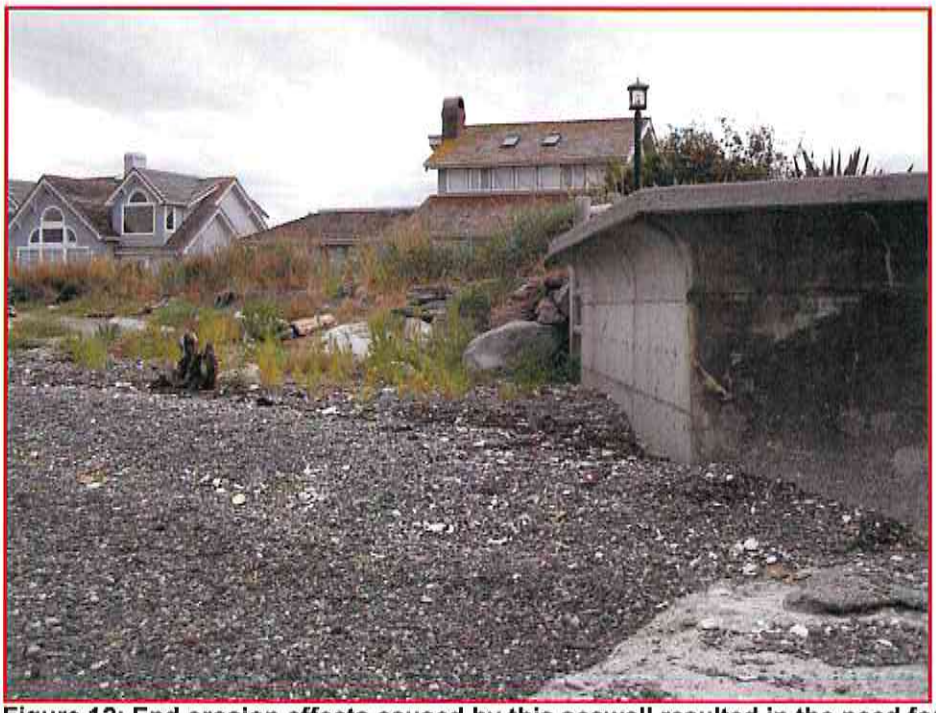

**Figure 12: End erosion effects caused by this seawall resulted in the need for hard rock on the adjacent neighboring property.**
(Kelsey Gianou photo.)

## Habitat/Biological Processes

Habitat and biological processes are important for critical species such as forage fish and salmon as well as overall nearshore health (Brennen & Culverwell, 2005). Shoreline stabilization can significantly alter shoreline habitat and the associated biological processes (Thom et al. 1994; Williams & Thom, 2001). Soft shoreline stabilization projects incorporate features that enhance or maintain natural habitat and biological processes into their design. Soft shoreline projects may thus mitigate some of the biological impacts that may occur with stabilizing the shoreline. The following are recommended proxy questions to consider when evaluating if a stabilization project will benefit or adversely impact shoreline habitat or biological processes.

Will the stabilization project…

- **maintain/enhance terrestrial and aquatic connectivity?**
  Traditional shoreline stabilization designs often create a disconnection between terrestrial and aquatic habitats (Shipman, 2010; Toft et al. 2010). This disconnection may be a physical feature (i.e. a wall) that prevents or inhibits nutrients and other materials from exchanging between terrestrial and aquatic habitats. This disconnection can also be a displacement feature (i.e. removal of vegetation) where important habitat contributions such as leaf litter, overhanging vegetation, and shade do not sufficiently cross the terrestrial/aquatic 'boundary'. **The incorporation of natural connection features such as overhanging vegetation that provides shade, leaf litter, and possibly large woody debris into the aquatic environment is a soft shoreline attribute. Also, projects that enhance or maintain the natural physical connection between the terrestrial and aquatic habitats have a soft shoreline attribute.**

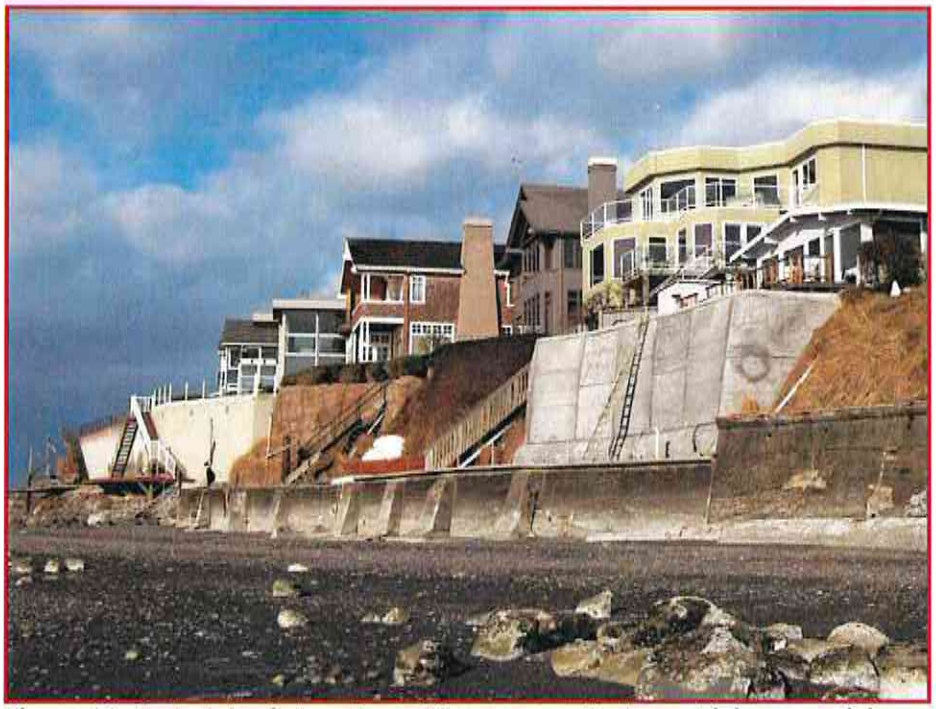

**Figure 13: A stretch of shoreline with poor aquatic-terrestrial connectivity.** (Hugh Shipman photo.)

- **maintain/enhance natural backshore habitat such as shoreline vegetation, wrack, and/or large woody debris?**
  Depending upon location and design, some shoreline stabilization techniques will result in the displacement or degradation of backshore habitat. This includes but is not limited to the reduction of native shoreline vegetation, a reduction in the accumulation of wrack on the shoreline, and/or reduced accumulation or retention of large woody debris (Thom et al. 1994; Williams & Thom, 2001; Shipman, 2010). Native shoreline vegetation, wrack, and large woody debris benefit the nearshore natural habitat (Brennen & Culverwell, 2005). **Stabilization techniques that maintain or enhance natural**

**backshore habitat such as native shoreline vegetation, wrack, and/or large woody debris have a soft attribute.**

Site specificity is very important for these attributes. Shoreline vegetation that is naturally occurring and native to a site should be used to the maximum extent feasible. Additionally, the requirement of large woody debris is only practical in areas where it would naturally accumulate. Some shorelines in Puget Sound accumulate and retain drift wood, while others do not. If a reach of shoreline does not naturally accumulate large woody debris, then making large woody debris retention a specific soft shoreline criterion would not be appropriate.

**Figure 14: Enhanced aquatic-terrestrial connectivity and backshore habitat.** This soft shoreline stabilization project replaced original riprap armoring. (Kelsey Gianou photo.)

- **maintain/enhance habitat for rare, vulnerable or valuable species?**
  Nearshore habitats that are utilized by rare/vulnerable/valuable species may require additional review with regards to what qualifies as a soft shoreline. **Those features that contribute to a stabilization project qualifying as soft should also contribute to the maintenance or enhancement of habitat for any sensitive species that may be present.** This will ensure that the soft techniques used will benefit the species. This may also help target which features qualify as soft for a particular stretch of shoreline. For example, a stretch of armored shoreline applying for a soft shoreline replacement has data indicating the forage fish have used the shoreline site for spawning in the past. Therefore, soft attributes such as native overhanging vegetation and spawning sized gravel for nearshore slope regrading should be included in the soft shoreline design.

WDFW maintains a list of Priority Habitats and Species that local governments are required to consider in shoreline inventories and characterizations. This list can be found at http://wdfw.wa.gov/conservation/habitat/.

## Intertidal Habitats

Soft shoreline stabilization projects may extend into the tidal zone. The regrading and addition of some fill below the OHWM can be important to the success of a soft shoreline stabilization project. Alteration and placement of fill into the intertidal habitat is generally discouraged by many agencies and regulatory authorities due to the potential impacts to sensitive species. However, soft shorelines can be an exception to this. The use of fill and regrading techniques for soft shoreline stabilization projects can lead to an enhancement of habitat features for sensitive species. This is particularly relevant in replacement stabilization scenarios where the previous stabilization structure has altered intertidal habitats (i.e. erosion and sediment scour at the base of a seawall).

In order to address this seemingly contradictory situation, use the following recommended proxy questions to determine whether or not alterations of intertidal habitat for shoreline stabilization will qualify as a soft shoreline and whether other regulatory authorities are likely to permit such actions.

Will the stabilization project…

- **maintain/enhance intertidal habitat?**
  **Soft shoreline projects should result in the enhancement or protection of intertidal habitat.** If the proposed fill will significantly degrade intertidal habitat (i.e. sediment the wrong size for forage fish spawning, significant destruction of eelgrass habitat, etc.) then the project should not be considered a soft shoreline.

- **use fill to create dry land below OHWM?**
  **Stabilization projects that use fill to expand property should not be permitted** [WAC 173-26-231(3)(c)].

Pursuant to Washington House Bill 2199 (2009), there are "relief" procedures established for instances in which a shoreline restoration project within an Urban Growth Area creates a shift in the OHWM, and this shift creates a use hardship for properties subject to new or extra regulation.

## Materials/Methods

The materials and methods used to stabilize a shoreline will greatly influence whether or not a project will qualify as a soft shoreline. The following are recommended questions relating to materials and methods and what may qualify as a soft shoreline.

- **Are the materials used similar to the natural environment?**
  The materials used in soft shoreline stabilization projects can vary widely. Materials can include but are not limited to rock, large woody debris, cobble, gravel, sand, plants,

wood, degradable fiber material, filter cloth, and limited use of concrete. One of the key components in evaluating whether the materials used contribute to a soft shoreline qualification is determining if these materials are representative of the surrounding natural environment. For example, in an undisturbed, natural shoreline setting with a gravel beach and some large woody debris, the materials most representative of the environment (gravel and large woody debris) would be more likely to contribute to a soft shoreline qualification than large rocks or structures made of concrete. Similarly, sand would also likely not be appropriate, and therefore would not be a qualifying soft shoreline attribute in this case.

It is important to remember, however, that some non-natural materials, such as concrete, may be used in limited instances for soft shoreline stabilization projects. This is because there may be some circumstances where it is environmentally preferable to use limited amounts of man-made materials in a soft shoreline. This is highly dependent on the site. Local jurisdictions are encouraged to put the burden on the applicant to demonstrate the specific needs for their project and how the proposed stabilization materials will meet soft shoreline criteria. Jurisdictions should consider the materials used in light of the physical, biological, habitat, and intertidal considerations outlined in previous sections. **Projects that maximize the use of natural, site appropriate materials have a soft shoreline attribute.**

- **How is it put together?**

  **The use of 'natural' or naturally occurring materials is not enough to be considered soft shoreline stabilization.** How the materials are used is also important. One of the biggest sources of confusion is the use of large woody debris. In general, large woody debris is encouraged in Puget Sound. However, the use of large woody debris, sometimes referred to as anchor trees, can be overzealous to the point where the end result is a hard structure that retains few soft shoreline attributes. The stacking and assembling of large wood into large, rigid structures is more or less creating a bulkhead/seawall out of natural materials. While this may be an improvement over man-made materials such as concrete or creosote logs, it does not generally achieve many soft shoreline attributes. The benefits of the materials and how they are used should be clearly outlined in the project proposal. It is not simply the use of a natural material, but how it is used to benefit the physical and/or biological habitats of a shoreline.

**Figure 15: A log crib alternative that has many of the characteristics of a traditional bulkhead.**
(Hugh Shipman photo.)

It is unlikely that the evaluation a soft shoreline stabilization permit will result in favorable answers to the entire list of recommended proxy questions. The important outcome is that permit staff are implementing soft shorelines with attributes appropriate to their jurisdiction to meet no net loss and SMA consistency. Jurisdictions are encouraged to prioritize which soft shoreline attributes are most important within their community (see Planning for Soft Shorelines) and to consider the specific needs of the shoreline site, reach, and drift cell in which the project will take place. The results of the evaluation will also depend upon the current shoreline condition (armored vs. natural), as that will influence the answers to many of the recommended proxy questions.

Local jurisdiction staff may not have the technical knowledge or in-house resources to answer all of these questions. Local jurisdictions are encouraged to require applicants to provide detailed information that can answer these questions, either through permit application requirements or pre-application meetings. A list of state resources, soft project review papers, and other relevant materials is given in Appendix B.

# Part V: Anticipated Challenges to Implementing Soft Shoreline Stabilization

Main sections included in Part V:

- Values and Attitudes toward Shorelines
- Risk Aversion
- Permitting Complexity
- Existing Hard Armoring
- Resistance to Change
- Cost of Hard Armoring Removal/Soft Project Installation
- Cost of Permitting
- Unfamiliarity with Soft Shoreline Techniques
- Lack of Incentives

There are many challenges and opportunities to implement soft shoreline stabilization. This guidance was created to help address some of the expected challenges and opportunities facing local jurisdictions. However, it is acknowledged that other potential challenges will occur that are outside the scope of this guidance. The purpose of this section is to briefly describe some anticipated challenges to soft shoreline implementation on a general level.

It is important to recognize that there will be implementation challenges that lie beyond the direct influence of local jurisdictions' management decisions. Shoreline stabilization involves a variety of stakeholders. Table 6, adapted from Roberts (2010), shows the diversity of stakeholders involved in shoreline stabilization, describing their main objectives and their areas of influence. Understanding affected stakeholders and their motives is important when considering the anticipated challenges to soft shoreline stabilization and to understanding what is driving hard vs. soft stabilization requests at the permit counter.

This section discusses a list of anticipated challenges to soft shoreline stabilization. This list is based on interviews with local planners and other individuals with soft shoreline experience as well as results from soft shoreline workshops and surveys with both public and professional participation (see in-text references). While local jurisdictions may have limited ability to directly influence some of the anticipated challenges, it is important to be aware of the range of issues to gain perspective and proactively direct future projects in a constructive manner, such as incentive or educational programs.

**Key Point: There is a range of anticipated challenges to soft shoreline stabilization implementation outside the direct influence of an SMP.**

**Table 6: Shoreline armoring stakeholders, their main objectives, and areas of influence.**

| Stakeholder | Objectives | Area of Influence |
|---|---|---|
| Property Owners | • Maximize the use of their property<br>• Aesthetics<br>• Maximize property value | • Individual's property<br>• Neighbors' property |
| Experts and Consultants | • Satisfy the client<br>• Make a profit<br>• Maintain credibility | • Geographical region in which they work |
| Government Regulators, Permitting and Compliance Officials | • Implement and enforce the regulations<br>• Resource stewardship | • Jurisdiction in which they work |
| Policymakers and Law-makers | • Re-election<br>• Maintaining the tax base<br>• Resource stewardship<br>• Serving their constituents<br>• Environment quality<br>• Quality of life<br>• Public health, safety and welfare | • Their jurisdiction<br>• Colleagues' jurisdictions |

Adapted from Roberts, 2010. A Report from the National Research Council: Mitigating Shore Erosion Along Sheltered Coasts.

## Values and Attitudes toward Shorelines

Attitudes and values may influence a person's behavior (Kaiser, 1999). Therefore, how property owners value their shoreline and what environmental attitudes they possess may influence how they will manage and enjoy their shoreline property. Understanding the values, attitudes, and motives of shoreline landowners can inform strategies for framing how a soft shoreline can benefit property owners.

For example, a shoreline landowner survey of the Port Susan Marine Stewardship area funded by the Northwest Straits Foundation result showed "view" as the most frequently cited value of shoreline property (Northwest Straits Foundation, 2014). It therefore may be a logical assumption that these shoreline landowners would not manage their coastal properties in a way that would significantly obstruct view. In addition, the value of "wildlife" was also commonly cited in Port Susan surveys (Northwest Straits Foundation, 2014). Therefore, in the Port Susan area, explaining to property owners how natural and soft shoreline stabilization may be used to

maintain and enhance desired views and wildlife sightings could reduce resistance to the implementation and enforcement of soft shorelines.

## Risk Aversion

Risk of damage to private property remains a primary issue related to soft shoreline stabilization. Overcoming the real and perceived risks experienced by shoreline property owners relating to soft shoreline stabilization is a significant challenge. Despite the intent and desire to "do the right thing" property owners may still resist soft stabilization because of real or perceived risk to property, structures, uses, safety, and sense of place.

There is a significant degree of uncertainty in understanding property owners' risk tolerance as this question is primarily informed through regional surveys, for which a number of factors potentially influencing participant responses are unknown. Regardless, a number of different survey efforts provide a glimpse into shoreline property owners' perception of risk related to shoreline stabilization. In a Lake Washington survey conducted by a University of Washington graduate student team, over 60% of shoreline landowner survey respondents agreed or strongly agreed that ineffective protection from boat wakes and erosion were barriers to creating natural shorelines on Lake Washington (Howell et al. 2007). This represents the perceived risks to property and other valued features of shoreline property if hard structures were to be removed. In Port Susan, 70% of survey respondents indicated that "erosion" was their biggest concern related to their shoreline property (Northwest Straits Foundation, 2014). In Kitsap, 82% of survey respondents indicated that "uncertainty of impacts to property" was a factor that affected their decision to undertake shoreline restoration on their property (Gerstel et al. 2012).

These perceptions of risk may be related to the lack of research or disclosure on the typical risks of shoreline property ownership, what the "normal" stabilization solution has been (i.e. surrounding hard armoring by neighbors), interactions with consultants and contractors, and personal experience. One potential technique for meeting this challenge may be to provide shoreline property owners with quality education on the risks and responsibilities of living on the shoreline. Other potential ways to manage risk aversion may be to provide additional data regarding erosion rates and wind fetch on a shoreline or to have trusted, non-regulatory technical experts attest to low erosion risk and/or soft shorelines success for a property (Green Shorelines Steering Committee, 2010; Northwest Straits Foundation, 2014).

Risk aversion will continue to be a challenge in implementing soft shorelines and will need to be addressed with each permit applicant, whether or not the risk is real or perceived.

Recommendation: Initially focusing implementation of soft shoreline stabilization in areas with low risk may demonstrate success and pave the way for property owners to be willing to accept more risk.

## Permit Complexity

The nearshore zone falls under a number of regulatory authorities and each may have its own process for sorting out regulatory priorities. The number and types of permits needed for a shoreline stabilization project will depend upon the location of the structures and activities. Some hard projects, such as bulkheads, retaining walls, and seawalls, can be sited above the OHWM.

This reduces the regulatory oversight of a number of agencies that need to be involved in review of the proposal. For example, a bulkhead sited above the OHWM for a single family residence will likely need a shoreline permit or exemption, any local building permits, and an HPA from WDFW. A soft project for the same site that proposes beach nourishment (regrading and adding material below OHWM and MHHW) will likely need a shoreline permit, local building permits, an HPA permit from WDFW, a Department of the Army permit issued by the ACOE, a 401 Water Quality Certification and/or Coastal Management Determination from Ecology, and permission from WDNR if tidal lands are owned by the state.

An additional complication is that local jurisdictions typically issue the first decision, and a project that is locally approved could still be denied through a state or federal review that happens after the local decision is issued. This could result in revisions to designs late in the process and a potential re-submittal of materials back to the local jurisdiction. This can delay the permitting process and can be costly (Chang et al. 2008).

Therefore, the timing, lack of coordination between local, state and federal agencies, and the number/types of permits required for some soft stabilization projects, creates a disincentive for the consideration and application of non-traditional stabilization projects. Through a survey in Lake Washington 52% and 27% of respondents strongly agreed and agreed, respectively, with the statement that the permitting process is a "...barrier to creating natural conditions on Lake Washington's shoreline" (Howell et al. 2007). In Kitsap County, 32% of survey respondents indicated that "permitting obstacles" were a top factor that affected their decision to undertake a shoreline restoration project (Gerstel et al. 2012).

Recommendation: Educating shoreline property owners on the permit process may help local jurisdictions set expectations and reduce frustrations with the complexity and time for permitting. Education should also include teaching property owners which governments have authority above and below the OHWM. Applicants should also be encouraged to talk with all agencies early in the process to help avoid unforeseen permitting issues and delays.

## Existing Hard Armoring

Many private shoreline properties currently have hard shoreline armoring because of the historical use of hard armoring techniques. This creates a challenge to implementing soft shoreline stabilization because the prevalence of existing hard armoring contributes to a social norm of hard armoring. Existing hard armoring requires significant change to remove or alter the armoring, may influence the property owners' perceptions of risk, and can create a cost burden to remove the armoring. Although nothing can be done to change the past, it is important to recognize the challenges of implementing and enforcing soft shoreline stabilization because of historical shoreline armoring in Puget Sound.

## Resistance to Change

Another potentially significant challenge local jurisdictions may face in implementing soft shoreline stabilization is simply a resistance to change. Even though there is evidence that people are generally in favor of restoring nearshore processes, there is also evidence that people are resistant to local change and have a "not in my back yard" response (Leschine, 2010).

Resistance to change may occur among a variety of stakeholders, including shoreline property owners, consultants, contractors, elected officials, and federal, state, and local jurisdiction staff. Transparency in the decision making process, clear technical information, and persistent and effective communication of the benefits of soft shoreline stabilization may help address this challenge.

## Cost of Hard Armoring Removal/Soft Project Installation

Hard armoring can be costly to install and costly to remove. Shoreline property owners who have paid to install a bulkhead may be unwilling to pay to remove the bulkhead to install a soft shoreline, particularly if the bulkhead is in good shape and functioning properly. This may be a significant disincentive for voluntary installations of soft shoreline stabilization. This also may be a disincentive for property owners who purchased a property with a bulkhead; they may be unwilling to pay to have a functioning bulkhead removed. Cost of bulkhead removal has been identified as a main challenge for property owners who are interested in removal and installing a soft shoreline (personal observation, King County Conservation District). Incentives, either financial or regulatory, are likely needed in order to address this challenge.

Another challenge is the wide range of costs associated with soft shoreline stabilization. It is often difficult to get a quote for a project due to the variety in soft stabilization techniques, materials, and nonstandard designs. Estimates for bulkhead installation, however, can be easier to obtain. This uncertainty of cost can be a disincentive for shoreline property owners to initially consider soft shoreline stabilization.

## Cost of Permitting

As mentioned in the Permitting Complexity challenge, soft shoreline projects can trigger more permit requirements than traditional hard structures depending upon placement of the structures. More permits generally also means more permit fees. The additional costs of these permits can be quite significant. This creates an additional barrier to the consideration and applications for soft shoreline stabilization.

## Unfamiliarity with Soft Shoreline Stabilization Techniques

Soft shoreline stabilization is not commonly used in Puget Sound. Traditional armoring such as bulkheads, seawalls, and riprap are more widespread and many contractors and consultants are more familiar with the engineering, design, installation, cost, permitting, and success of hard armoring structures. Because of experience and specialization with traditional hard structures, contractors and consultants may recommend hard armoring over unfamiliar soft shore armoring techniques. When recommending an unfamiliar option, contractors run the risk of not being able to answer with certainty how likely the project will protect from erosion, what it will cost, how long it will take to permit, or the types of permits needed. There is also the possible issue of liability or reputation decline if a project fails.

Unfamiliarity and the associated risks can be disincentives for contractors and consultants to promote the use soft shoreline stabilization to their clients. This challenge can be addressed by educating contractors and consultants about soft shorelines, how to install and design soft projects, and how using soft shore techniques can be beneficial to their business.

The issue of unfamiliarity with soft shoreline stabilization is not limited to contractors and consultants. A Lake Washington survey indicated that many shoreline property owners on Lake Washington feel they are unfamiliar with soft stabilization techniques (Howell et al. 2007). To help address this challenge, the topic of soft shore stabilization has been discussed in public workshops and informational pamphlets and booklets have been created (see Appendix B).

## Lack of Incentives

Behavior can be influenced by incentives and disincentives (Stern, 2006). Many of the above described challenges are often perceived as disincentives to soft shorelines (permitting complexity, cost, etc.). There is also currently a lack of effective *incentives* applicable to soft shorelines. Soft shorelines often involve some level of personal property risk or uncertainty for the sake of providing a public benefit. Therefore, incentives that increase personal benefit will likely help offset the perceived and real risks to private property owners installing soft shorelines. Incentives such as streamlined permitting, grant assistance, recognition, and tax reductions are just some of the ideas that state, local, and non-profit organizations are considering for soft shorelines.

While incentives may serve as an important part of soft shoreline management, it is anticipated that success will depend on effective and appropriately implemented regulations. This will ensure that the incentives used will be valuable and fair. The combination of regulations and incentives may increase the success of soft stabilization implementation.

Note: This discussion of incentives is not intended to cover mitigation where the property owner would be offsetting (avoiding, minimizing, or mitigating) impacts from a proposed development.

# Part VI: Conclusion

The use of soft shoreline stabilization is intended to maintain and enhance shoreline ecological functions. The State of Washington, through the updated Shoreline Master Program Guidelines administered by the Washington Department of Ecology, requires planning for and implementing a preference for soft shoreline stabilization. This guidance provides information and recommendations for this approach. Specific strategies necessarily will vary by jurisdiction, but information in this guidance, along with lessons learned from the experiences of other jurisdictions, should help communities design and carry out a strategy that meets their unique needs.

Challenges will come with incorporating and administering updated regulations, and as with any change there is a learning curve to understanding and implementation. This guidance provides a foundation for understanding the Shoreline Master Program Guidelines in terms of soft shoreline stabilization. Jurisdictions should consider how they can apply or tailor this guidance to most effectively address local circumstances and facilitate implementation of soft shoreline stabilization policies.

Many topics and recommendations were presented within this document. The following is a short list of some key messages:

- Soft shoreline projects should meet the intent of soft shoreline stabilization policies.
- Context is important when considering what features are most appropriate for soft shorelines.
- Soft shorelines must be demonstrated to be necessary before they are permitted.
- There are many challenges to realizing appropriate soft shoreline stabilization projects; communities should understand and prepare for these challenges.

Local governments are encouraged to utilize these key messages for planning and permitting soft shoreline stabilization projects. The application of these key messages as well as other topics and recommendations presented throughout this guidance will help staff successfully execute the policies in the Shoreline Master Program Guidelines and local Shoreline Master Program provisions.

Community experience will contribute to the successful use and acceptance of soft stabilization methods. Soft shoreline stabilization is, however, a complex topic. New science will inform us on where and what types of soft projects are favorable. Feasibility, risk, and homeowner perceptions will continue to strongly influence the types of stabilization projects proposed. New and innovative designs will likely test community and policy boundaries. Considering the on-going regional interest in this issue, interested parties are expected to address these complexities in a way that satisfies state requirements and addresses the needs of local communities.

The Washington Department of Ecology remains committed to working with local jurisdictions to implement strategic Shoreline Master Programs. As one of the department's first

implementation guidance documents related to this topic, there will be many lessons learned regarding the style, information, and specificity of examples. Desirable topics for future guidance have already been noted. For instance, further policy clarification and specific soft examples (construction designs and demonstration of ecological impact avoidance or enhancement) are desired. Examples of how to use the permitting process to "soften" harder designs or how soft stabilization can be used in mitigation sequencing have also been requested. Your thoughtful suggestions are encouraged and will help shape future guidance.

The information provided in this document is merely one part of a larger, healthy shorelines picture for Puget Sound. This information can be used in concert with technical design guidance, social marketing strategies, incentive programs, and other efforts. The foundation for the intent and regulation of soft shorelines provided in this guidance will contribute to the appropriate use of these other efforts. Non-Shoreline Master Program information and influences will improve Shoreline Master Program implementation and provide necessary catalysts for addressing soft shoreline challenges and opportunities. The combination of successful Shoreline Master Program planning and administration with other programs is important to soft shorelines and the environmental health of Washington's shorelines.

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# Appendices

## Appendix A. Examples of Soft Shoreline Stabilization

### Samish Island

*Shoreline Type*: Barrier beach/spit

*Previous shoreline condition*: A stretch of homes on the north beach of Samish Island, some with bulkheads and others without, were experiencing rapid erosion in the 1980s-90s, leading to bulkhead failure in 1996-97.

*Soft Shoreline Stabilization*: Beach nourishment/gravel placement was done waterward of existing bulkheads in 1998. This nourishment was an alternative to more riprap and/or larger seawalls.

*Soft attributes*: Addition of soft, natural materials; increased biologic connectivity; reduced artificial steep gradient; vegetation enhancement; allowed for the accumulation of detritus and woody debris; enhancement for priority species.

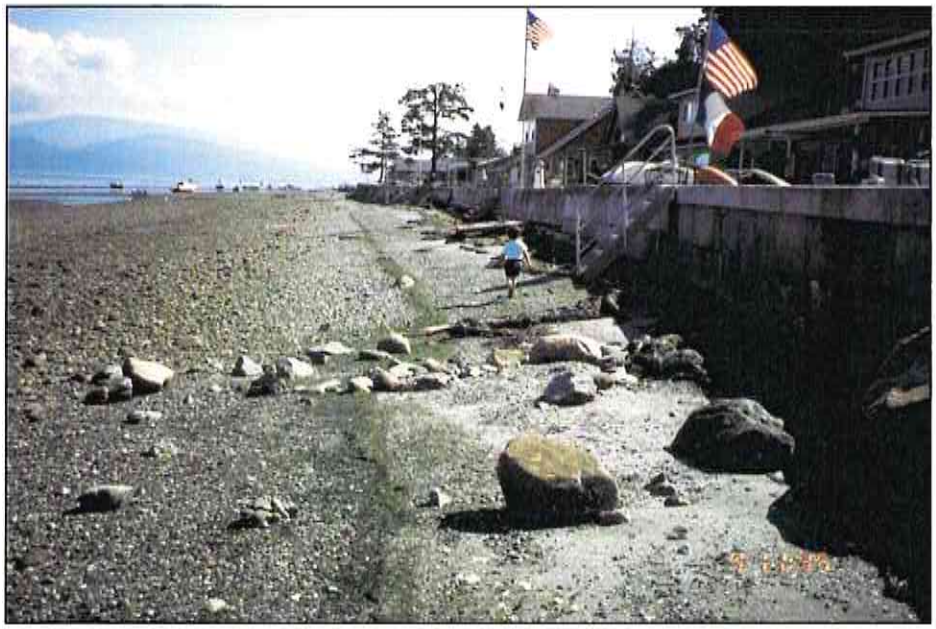

**Figure 16: Samish Island, before soft stabilization.**
(Hugh Shipman photo.)

**Figure 17: Samish Island, after soft stabilization**
(Hugh Shipman photo.)

## Seashore Lane

*Shoreline Type*: Barrier beach

*Previous shoreline condition*: This was a shoreline with no stabilization. A storm in the mid 2000's caused some erosion.

*Soft Shoreline Stabilization*: A log crib structure was built and covered with gravel, sand, logs, and dune grass. This effectively created a dune berm stabilized by vegetation and the log crib. The project was completed in 2006. This project has held up well and serves to protect homes and yards from wave overtopping during storms.

*Soft attributes*: Low gradient; natural materials; allow for natural accretion and erosion cycles; vegetation enhancement

**Figure 18: Seashore Lane before soft stabilization.**
Photo taken 2006.
(Hugh Shipman photo.)

**Figure 19: Seashore Lane after soft shoreline stabilization.**
Photo taken 2013.
(Kelsey Gianou photo.)

## Marine Park, Bellingham

*Shoreline Type*: Artificial fill

*Previous shoreline condition*: Riprap

*Soft Shoreline Stabilization*: The riprap was removed and fill was pulled back. Beach nourishment was used to create a pocket beach with a groin at either end. The project was completed in 2004.

*Soft attributes*: Lower, more natural beach gradient; spawning gravel and other appropriate sized sediment; soft, natural materials; reduced scour; some dynamic and flexible features; increased connectivity.

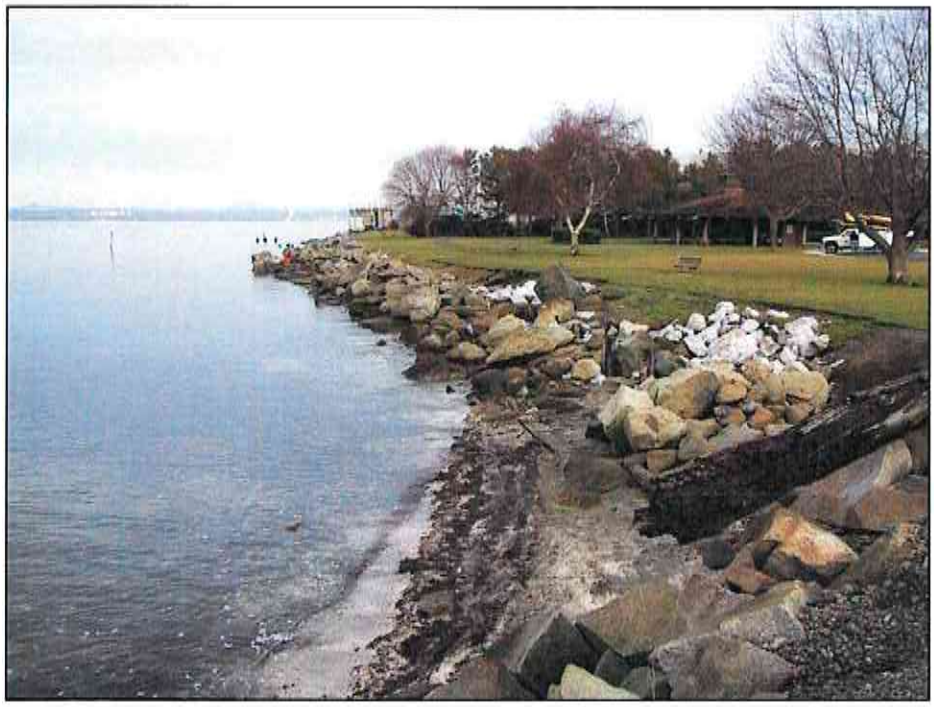

**Figure 20: Marine Park, Bellingham before soft stabilization.**
(Coastal Geologic Services photo.)

**Figure 21: Marine Park, Bellingham after soft stabilization.**
(Hugh Shipman photo.)

## North side Blakely Harbor, Bainbridge Island

*Shoreline Type*: Low bank influenced by artificial historical fill.

*Previous shoreline condition*: Historic fill and crib wall covered part of the site. The site was historically modified by industrial activities in the harbor.

*Soft Shoreline Stabilization*: Soft stabilization occurred along 400 linear feet of shoreline. Sections involved removal of crib wall and historic fill. A storm berm was established in front of a restored narrow salt marsh. Backshore habitat was enhanced by replacing nonnative vegetation with native vegetation. Wood logs were anchored using ecology blocks. The permit for this project was issued in 2005.

*Soft attributes*: Natural materials; backshore habitat enhancement; lower gradient

**Figure 22: Port Blakely Harbor, Bainbridge Island, after stabilization.**
(Joshua Machen, City of Bainbridge Island photo.)

**Figure 23: Port Blakely Harbor, Bainbridge after soft shoreline stabilization; view from water.**
Photo taken 2007.
(Hugh Shipman photo.)

## Weaverling Spit

*Shoreline Type*: Spit

*Previous shoreline condition*: The had an eroding bank, consisting of native soils, historic fill, and a previous attempt at erosion control.

*Soft Shoreline Stabilization*: Mixed sand and gravel was used for beach nourishment and combined with four anchored drift sill logs. Vegetation enhancement was conducted on the backshore. The project was completed in 2009.

*Soft attributes*: Some dynamic features; natural materials; aquatic-terrestrial connectivity; low gradient; soft substrates; minimal use of structural elements; allows for sediment and detritus accumulation.

**Figure 24: Weaverling Spit, Fidalgo Bay before soft stabilization.**
(Hugh Shipman photo.)

**Figure 25: Weaverling Spit, Fidalgo Bay, after soft stabilization.**
(Hugh Shipman photo.)

## Kitsap Memorial Park, Southern portion

*Shoreline Type*: Medium bluff backed beach

*Previous shoreline condition*: Timber Bulkhead

*Soft Shoreline Stabilization*: The previous bulkhead was removed. The southern portion of the beach was stabilized using gravel placement and anchored large woody debris. This is a softer approach than was used on the mid and northern portions of the beach where a new rock bulkhead was constructed slightly farther landward than the old one. The project was completed in 2011.

*Soft attributes*: Increased aquatic-terrestrial connectivity; natural materials; increased some sediment connectivity; similar to naturally occurring geomorphic settings.

**Figure 26: Kitsap Memorial Park, Southern Beach before bulkhead removal.**
(Hugh Shipman photo.)

**Figure 27: Kitsap Memorial Park, Southern Beach after bulkhead removal and soft shoreline stabilization.**

Photo taken 2013.

(Kelsey Gianou photo.)

## Lopez Village, San Juan County

*Shoreline Type*: Artificial fill on a sand spit

*Previous shoreline condition*: Failing wooden bulkhead

*Soft Shoreline Stabilization*: The failing wooden bulkhead was removed. Fill and other material behind the failing bulkhead were removed. Large rocks and some large wood were used to stabilize the lawn-beach transition area. The new stabilization features were placed landward of the removed bulkhead. Gravel and sand were added as well as some native vegetation.

*Soft attributes*: Lowered gradient; natural materials; increased aquatic-terrestrial connectivity; reduced scour; some dynamic and flexible features.

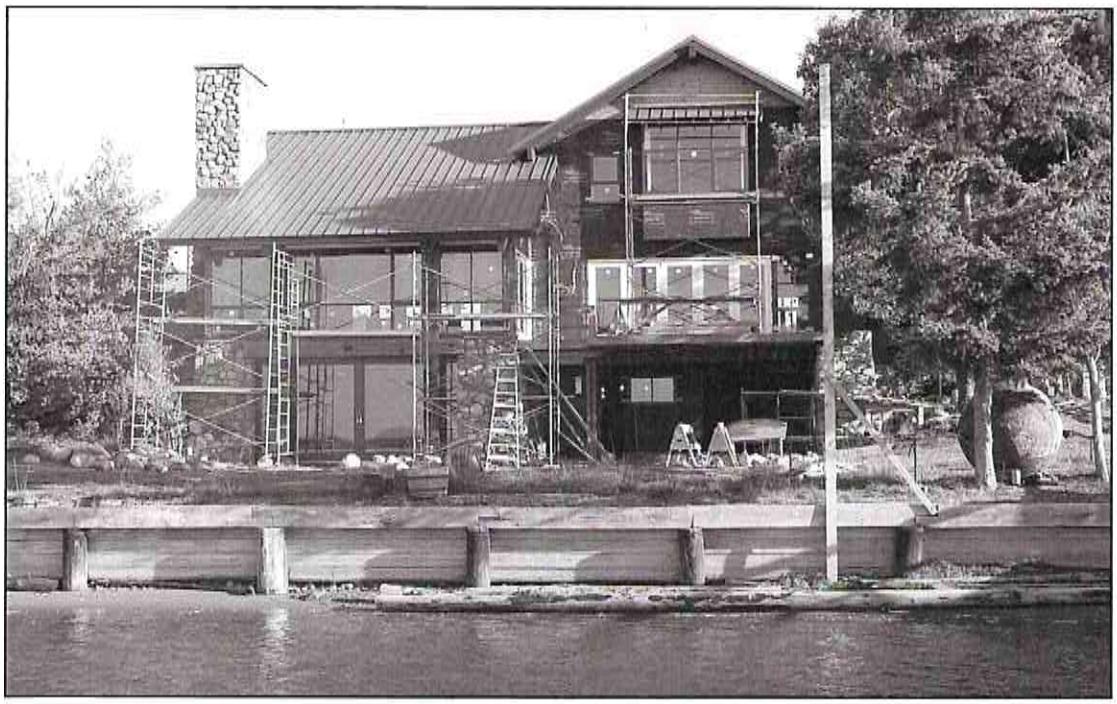

**Figure 28: Fisherman's Bay, Lopez Island, before bulkhead removal.**
(Peter Kilpatrick, Ravenhill Construction Inc. photo.)

**Figure 29: Fisherman's Bay, Lopez Island after bulkhead removal and soft stabilization.**
(Peter Kilpatrick, Ravenhill Construction Inc. photo.)

The Marine Shorelines Design Guidelines has conducted thorough case studies of a variety of soft shoreline stabilization projects. These case studies provide great detail on the projects and conducts performance evaluations for the projects.

Marine Shorelines Design Guidance Reference: Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. J. Barnard, R. Carman, and H. Shipman. 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington.

This guidance is available online at WDFW's website at:
http://wdfw.wa.gov/conservation/habitat/planning/ahg/

# Appendix B. Resources

## Washington State Department of Ecology Resources:

Shoreline Planners Toolbox http://www.ecy.wa.gov/programs/sea/shorelines/smp/toolbox.html

Washington Coastal Atlas http://www.ecy.wa.gov/programs/sea/sma/atlas_home.html

Ecology Green Shorelines Website
http://www.ecy.wa.gov/programs/sea/greenshorelines/index.html

Ecology Contacts for Technical Assistance
http://www.ecy.wa.gov/programs/sea/sma/contacts/index.html

## Other State Resources

Washington Department of Fish and Wildlife Contacts for Planning Assistance
http://wdfw.wa.gov/conservation/habitat/planning/gma_sma/

Washington Department of Fish and Wildlife Habitat Biologist Search
http://wdfw.wa.gov/conservation/habitat/ahb/

Washington Department of Fish and Wildlife Priority Habitats and Species
http://wdfw.wa.gov/conservation/habitat/

Washington Department of Natural Resources Information for Leasing State-Owned Aquatic Lands
http://www.dnr.wa.gov/BusinessPermits/Topics/ShellfishAquaticLeasing/Pages/aqr_aquatic_land_leasing.aspx

## Organizations Involved with Funding

Puget Sound Marine and Nearshore Grant Program Lead Organization- Washington Department of Fish and Wildlife and Washington Department of Natural Resources

United States Environmental Protection Agency

Puget Sound Partnership

Washington Department of Ecology

Washington Department of Fish and Wildlife

Washington Department of Recreation and Conservation

Local Lead Entities

Local Integrating Organizations

Salmon Enhancement Groups

The Northwest Straits Initiative

Local Land Trusts

## Organizations Involved with Outreach/Education

Washington Sea Grant

Washington State University Extension

Puget Sound Partnership

Local Soil and Water Conservation Districts

Washington Coastal Training Program-Padilla Bay

## Papers Relating to Review of Soft Shoreline Stabilization

Zelo, I., H. Shipman, and J. Brennan. 2000. *Alternative Bank Protection Methods for Puget Sound Shorelines*. Pub No. 00-06-012. Prepared for the Shorelands and Environmental Assistance Program, Washington Department of Ecology, Olympia, Washington. https://fortress.wa.gov/ecy/publications/publications/0006012a.pdf

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Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. J. Barnard, R. Carman, and H. Shipman. 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. http://wdfw.wa.gov/conservation/habitat/planning/ahg/

## Papers Relating to Shoreline Riparian Habitat

Brennan, Culverwell, Gregg, and Granger. 2009. *Protection of Marine Riparian Functions in Puget Sound, Washington*. Prepared by Washington Sea Grant. Prepared for Washington Department of Fish and Wildlife, Olympia, Washington.
http://wdfw.wa.gov/publications/00693/wdfw00693.pdf

*Marine Riparian Areas: These Important Nearshore Environments Offer a Wealth of Functions and Benefits*. WGS-AS 05-01. Washington Sea Grant, Seattle, Washington.
http://wsg.washington.edu/mas/pdfs/rip_functions-benefits.pdf

Brennan, James S., and Hilary Culverwell. (2004). *Marine Riparian: An Assessment of Riparian Functions in Marine Ecosystems*. Published by Washington Sea Grant Program Copyright 2005, UW Board of Regents Seattle, Washington.
http://wsg.washington.edu/mas/pdfs/marine_riparian_assess.pdf

## PNSERP Publications

For a full list and access to PNSERP publications, please go to:
http://www.pugetsoundnearshore.org/technical_reports.html

Clancy, M., I. Logan, J. Lowe, J. Johannessen, A. MacLennan, F.B. Van Cleve, J. Dillon, B. Lyons, R. Carman, P. Cereghino, B. Barnard, C. Tanner, D. Myers, R. Clark, J. White, C. A. Simenstad, M. Gilmer, and N. Chin. 2009. *Management Measures for Protecting the Puget Sound Nearshore*. Puget Sound Nearshore Ecosystem Restoration Project. Technical Report 2009-01. Washington Department of Fish and Wildlife, Olympia, Washington.

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Downing, J. 1983. *The Coast of Puget Sound*. Sea Grant Publications, University of Washington Press, Seattle, Washington.

## Public Outreach Resources and Materials

*Green Shorelines: Bulkhead Alternatives for a Healthier Lake Washington*. City of Seattle.
http://www.govlink.org/watersheds/8/action/greenshorelines/Green_Shorelines_SecondEdweb.pdf

Greening Your Shoreline. Watershed Resource Inventory Area 8.
http://www.govlink.org/watersheds/8/action/GreenShorelines/default.aspx

Green Shorelines Blog: http://greenshorelines.wordpress.com/

*Shoreline Restoration: Alternatives for Kitsap County Shorelines*. Kitsap County Department of Community Development and Washington Department of Ecology.

Washington State University Extension Shoreline Living Videos
Part 1: http://www.youtube.com/watch?v=8_2HzHGV6BQ
Part 2: http://www.youtube.com/watch?v=cSfTHZv7E3E&feature=youtu.be
Part 3: http://www.youtube.com/watch?v=soJSzOQ9Aq0&feature=youtu.be

*Guide for Shoreline Living, Shore Stewards Booklet*. Shore Stewards, Washington State University Extension.
http://county.wsu.edu/mason/nrs/water/Documents/Guide%20to%20Shoreline%20Living.pdf

*Updated Guide for Shoreline Living, Shore Stewards Booklet*. 2013. Washington State University Extension. http://www.harborwildwatch.org/stewardship-1/guide-to-shoreline-living/

*Bulkheads and Shoreline Permits Fact Sheet*. Watershed Resource Inventory Area 8.
http://www.govlink.org/watersheds/8/action/GreenShorelines/Bulkheadfactsheet2012.pdf

*Docks and Shoreline Permits Fact Sheet*. Watershed Resource Inventory Area 8.
http://www.govlink.org/watersheds/8/action/GreenShorelines/Dockfactsheet2012.pdf

Slope Stabilization and Erosion Control. Washington State Department of Ecology
http://www.ecy.wa.gov/programs/sea/pubs/93-30/index.html

Managing Drainage on Coastal Bluffs. Washington State Department of Ecology
http://www.ecy.wa.gov/programs/sea/pubs/95-107/intro.html

Managing Vegetation on Coastal Slopes. Washington State Department of Ecology
http://www.ecy.wa.gov/programs/sea/pubs/93-31/intro.html

## Other Relevant Resources

Governor's Office of Regulatory Innovation and Assistance http://www.ora.wa.gov/

Green Shorelines Steering Committee. 2010. *Summary Report: Green Shorelines for Lakes Washington and Sammamish*. Water Resource Inventory Area 8. Shorelands and Environmental Assistance Program, Washington Department of Ecology, Olympia, Washington. Pub No. 10-06-08.
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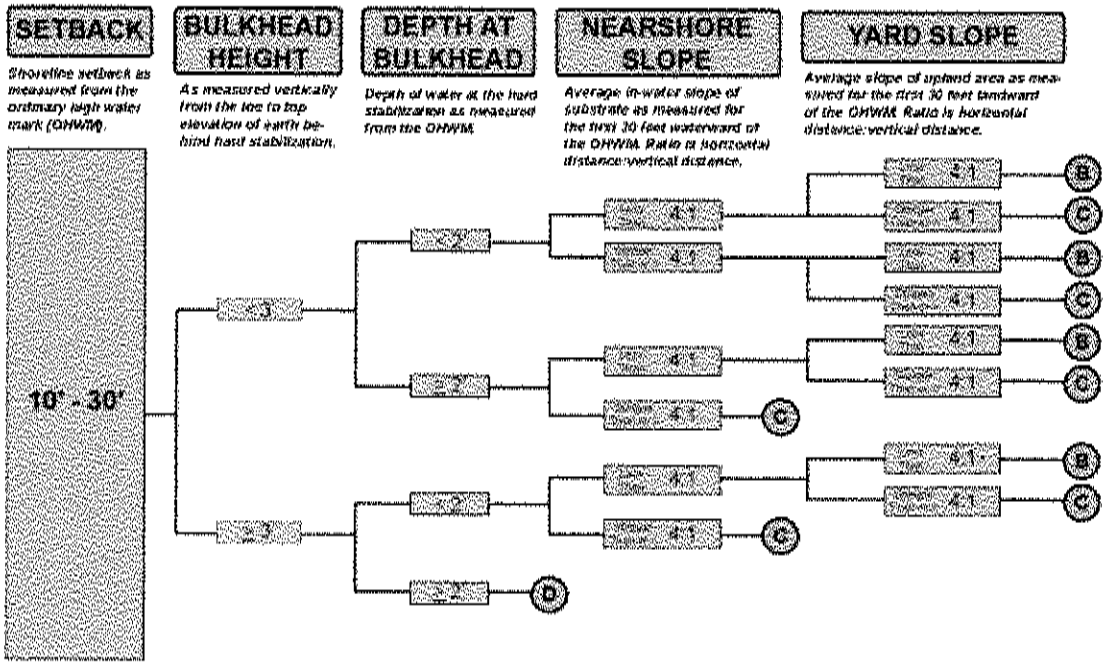
# Appendix C. Kirkland Zoning Code Plates 43A and 43B




**Typical Options:**

- (A) Full beach, beach cove, pullback, bioengineering, enhancement, gradient improvement
- (B) Beach cove, pullback, bioengineering, enhancement, gradient improvement
- (C) Pullback, bioengineering, enhancement, gradient improvement
- (D) Bioengineering, enhancement, gradient improvement

**Definitions:** (In Order of Restoration Preference)

**Full beach**: hard stabilization removal and beach restoration

**Beach cove**: partial hard stabilization removal and pullback to create beach cove

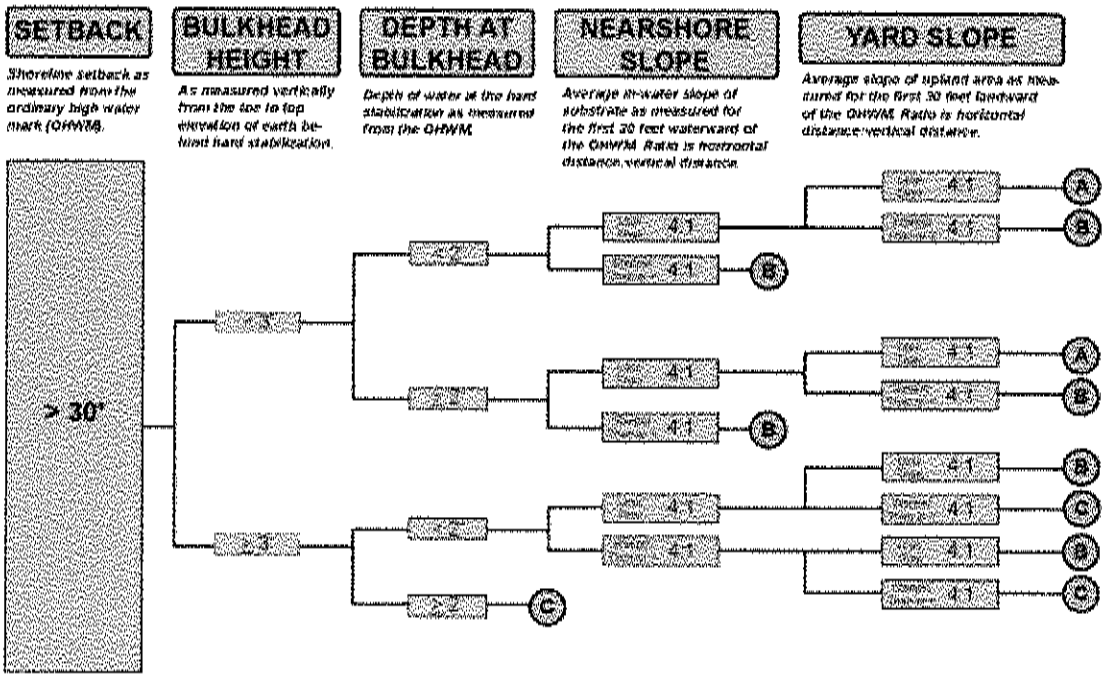
**Hard stabilization pullback**: repositioning of hard stabilization landward of existing location to improve shoreline gradient and possibly form a beach

**Slope bioengineering**: shoreline stabilization using plant material and other biodegradable materials to hold upland soils in place

**Hard stabilization enhancement**: hard stabilization may stay in same general location, but modifications may include sloping back existing hard structure and/or modifying material type and layout to create potential beach cove areas

**Nearshore gradient improvement**: installation of gravel/cobble substrate wedge for the purposes of improving nearshore gradients

**Notes**: Sites with less than a 10' shoreline setback are not included with this decision tree as those sites will likely require some form of hard stabilization. However, those sites may still benefit from the addition of an in-water gravel/cobble wedge to improve shoreline gradient along with a native plant buffer.




**Typical Options**:

- (A) Full beach, beach cove, pullback, bioengineering, enhancement, gradient improvement
- (B) Beach cove, pullback, bioengineering, enhancement, gradient improvement
- (C) Pullback, bioengineering, enhancement, gradient improvement
- (D) Bioengineering, enhancement, gradient improvement

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