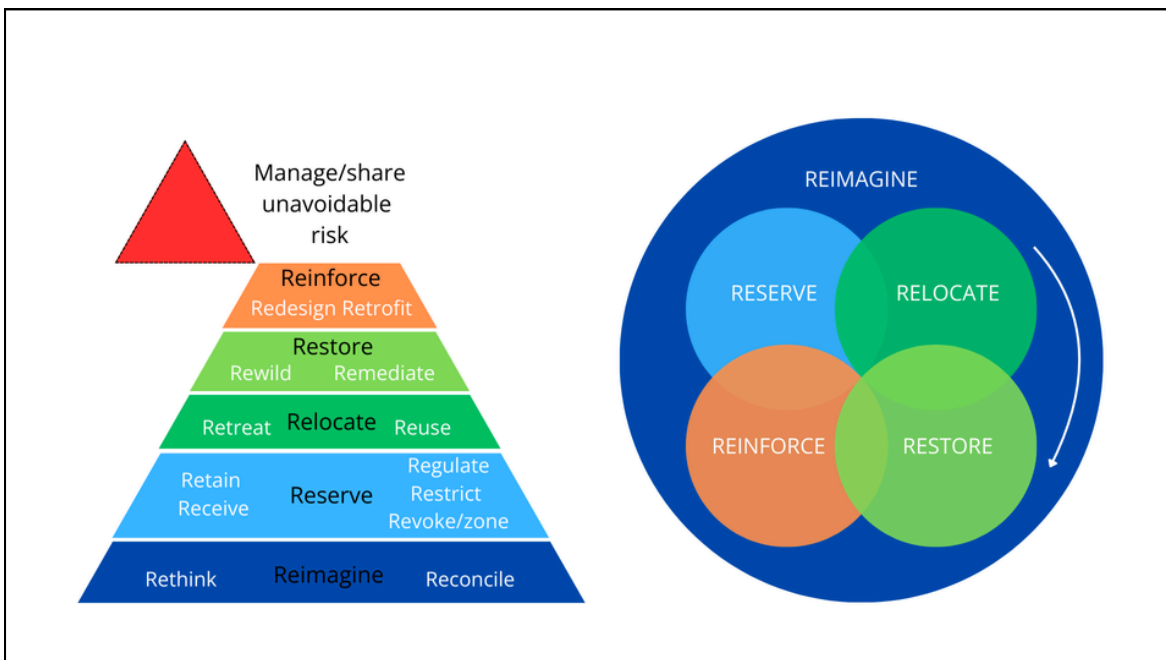


Green Shores® and the 5Rs for Nature-Based Coastal Adaptation

December 2024

Climate Change Adaptation and the 5Rs Framework

Adaptation is taking action to reduce the negative impacts of climate change. Nature-based solutions (NbS) address challenges like climate change in a sustainable way by working *with* nature (1). Nature-based coastal adaptation (NBCA) is a subset of NbS that focuses on maintaining or enhancing natural coastal processes while strategically using “hard elements” for shoreline protection (2). **The 5Rs framework guides NBCA conception and implementation using the principles of: *Reimagine, Reserve, Relocate, Restore and Reinforce*.** The 5Rs framework differs from other NBCA frameworks due to its prioritization of non-physical actions, such as, understanding our relationship to the shore and how it might transform (2). This is reflected in *Reimagine* as the foundational principle on which the other *Rs* are connected and dependent. Following the 5Rs framework can facilitate the creation of NBCA solutions that are effective, lasting, and that expand upon rather than constrict future options (2).



Visual representations of the 5Rs framework for Nature-Based Coastal Adaptation: The left and right charts were adapted from Sherren et al. (2024) and van Proosdij et al. (2021) respectively (2-3). Both charts depict *Reimagine* as the foundational Nature-Based Coastal Adaptation option, with preference then moving to *Reserve, Relocate, Restore* and finally *Reinforce*, or utilizing a combination of the *Reimagine* and the four other “R”s.

The 5Rs for Nature-Based Coastal Adaptation

Reimagining involves creating new understandings of shared landscapes, values, and norms of living, shifting away from controlling, dominating, and protecting property from coastal processes. Collectively *Reimagining* what it means to live a good coastal life enhances the social and political viability of additional adaptation options (2).

Reserve aims to ensure uninterrupted space for nature-based coastal adaptation, natural coastal habitats, and environmental processes (2). In further detail, “Reserve uses policy and regulations to enable coastal dynamism by discouraging, restricting, or prohibiting development in critical areas of the coastal zone” (2, p5). Additionally, *Reserve* may include retaining or receiving land for future relocation of human activities, restoration, or additional protection methods as required.

Relocate usually involves “the physical moving of people and their activities, including relocation and/or removal of buildings and non-defensive infrastructure under threat from coastal flooding and erosion” (2, p6). *Relocate* relies on *Reimagine* to gain public support by communicating risks and opportunities and encouraging self-determination of people and communities while *Reserve* creates suitable buffer space for the *Relocation* of individuals or communities.

To **Restore** is to acknowledge the role that natural ecosystems play in NBCA and to encourage healthy ecosystems where they are absent or degraded (2). *Restore* encourages a collective rethinking of the idea that ecosystems can and should be managed, and instead promotes shifting towards efforts like rewilding rather than command-and-control landscape and conservation approaches (2).

Reinforce is the final option to be used after, or in combination with, *Reimagine*, *Reserve*, *Relocate* and *Restore* approaches. “Reinforce acknowledges that it will be necessary in many situations to hold some line of coastal protection” using hard and/or natural elements (2, p7). Where possible these coastal protection measures should be planned with space and forethought rather than as hasty reactions to coastal impacts like flooding and erosion.



This Shore Up event, presented for the Halifax Regional Municipality and led by Helping Nature Heal, helped to spark re-imagination of the responsibilities we all have to our shared shoreline spaces.



This house, just left of center, has reserved enough space between it and the water for shoreline processes to occur uninhibited.



With the removal of tidal flow barriers, the Belcher St. salt marsh in Kentville, NS, restored itself within 2-3 years. The marsh protects against flooding and erosion and provides important habitat along the Jijuktu'kwejk River.

Green Shores and the 5Rs Principles

Green Shores® is a program of the Stewardship Centre for BC that helps build landowner capacity to manage natural hazards, minimize the impacts of shoreline development, protect shoreline properties, and preserve or enhance shoreline ecosystems through nature-based solutions.

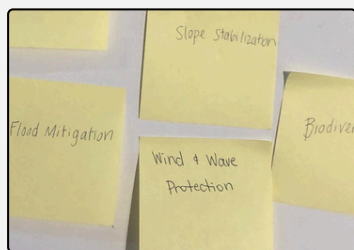
Green Shores supports and provides examples of the 5Rs principles in action through training workshops, Green Shores for Homes (GSH) and Green Shores for Shoreline Development (GSSD) credits & ratings guides (4-5), and local government groups.

Green Shores promotes **Reimagining** of what stewarded shorelines could look like.

For example, **Category 4: Shoreline Stewardship** has four credits focused on shoreline collaboration, public information and education, conservation easement or covenant, and shoreline stewardship participation. These credits help shoreline landowners to rethink shorelines from spaces that serve private interests to spaces that provide public environmental, recreational, educational, or aesthetic services.

Additionally, the public outreach and education actions encouraged in the Green Shores credits & ratings guides increase public familiarity with shore-friendly designs, which can empower more property owners to trust natural methods of erosion and flood protection, and reduce resistance to this kind of landscape change.

Perhaps most importantly, Green Shores brings shoreline values to the forefront of conversations. In Level 1 training, participants are asked to brainstorm and share shoreline values using their personal and professional experiences. In doing so they are acknowledging and considering values held by themselves or their communities that are often implicit.



Example shoreline values held by Green Shores trainees.

When individuals and communities understand what values they hold closely, they can better determine adaptation options that address shoreline threats while protecting those values.

Green Shores encourages **Reserving** land to provide space for natural, dynamic shoreline processes to occur away from human activities.

Keeping coastal lands as natural spaces and implementing setbacks are examples of policy and regulatory tools that *Reserve*. The Nova Scotia and British Columbia Green Shores Local Government Groups support their member municipalities to implement policy and regulatory tools by creating a space for networking, collaboration, and knowledge sharing. The British Columbia Green Shores Local Government Group has been involved with the creation of resources for municipalities to help understand adaptation options that provide this safe space for human activities, such as the *Green Shores Policy and Regulatory Tools for Local Governments: A survey of shoreline management in bylaws, plans and policies* (6).



Local government group members at the annual in-person meeting.



A natural, cobble shoreline backed by an eroding bluff in Nova Scotia.

Green Shores and the 5Rs Principles Continued

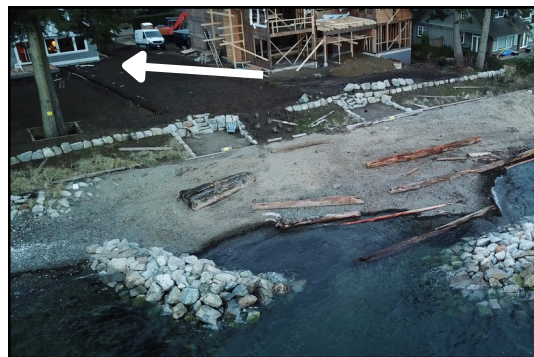
Green Shores discusses **Relocating** where appropriate.

GSH **Credit 1.6: Managed Retreat** encourages property owners to move existing buildings that are at risk of shoreline erosion or other hazards to avoid the need for future shore protection measures. This option is advised for consideration if the building(s) can be moved within or off the property to a suitable location. A suitable location is one where the building(s) can be placed far enough from the shore to allow for the natural dynamics of the shoreline for 80 years or the life of the building, whichever is greater, without compromising other required setbacks.

Green Shores showcases **Restoration** options and best practices.

One of the four guiding Green Shores principles is to maintain and enhance shoreline habitat diversity and function. **Category 2: Shoreline Habitats** implements this principle by encouraging actions such as: enhancing critical, sensitive, or migratory bird habitat stewardship (**Credit 2.1**); maintaining trees and snags (**Credit 2.3**); and removing invasive plants (**Credit 2.4**). The Green Shores credits & ratings guides and training workshops provide information on beneficial actions to maintain, enhance, or create habitat while leaving flexibility for practitioners to adapt and plan projects best suited to the site.

Similarly, GSSD **Credit 5: Restoration/Enhancement of Aquatic Habitats** aims to recover ecosystem features, functions and specific aquatic habitat areas by restoring or creating highly valued aquatic habitats, including critical or sensitive habitats, where previous development has impacted the habitat. The gold-rated GSSD New Brighton Park project in Vancouver BC, achieved this credit by restoring the ecological function of a former industrial site by removing artificial fill and contaminated soil, creating a lagoon and marsh system, and planting additional riparian and salt marsh vegetation (5). This increased overall ecological function in an area that is critical for both juvenile salmon, and resting and feeding shorebirds.



The Higson Crescent project in Qualicum Beach, BC is an example of a gold-rated GSH project in which one of the two original houses was relocated back and across the property to an area that will be much less vulnerable to sea level rise and increased storms. (7).



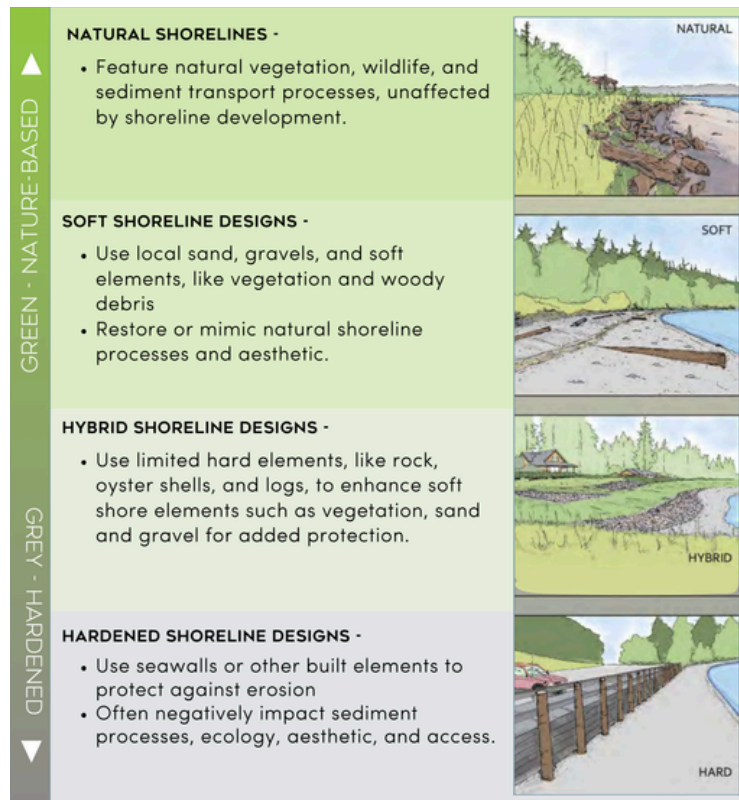
New Brighton Park project in Vancouver BC, transformed a former part of an industrial harbour into a restored coastal lagoon and marsh system (5). The additional 300 m of shore length created intertidal and riparian habitats on the previously degraded site. The photos above and below are before and after Green Shores certification respectively.

Green Shores and the 5Rs Principles Continued

Green Shores integrates *Reinforce* options where necessary.

Green Shores promotes designs that fall within ‘natural to hybrid’ for shoreline treatments. Hybrid designs use minimal hard elements such as logs or rocks to enhance the function of soft shore elements such as vegetation, sand and gravel. It is recognized that hard armouring may be required at a site but that a grey or hardened shoreline protection approach is not recognized as a nature-based Green Shores design. This aligns with the 5Rs framework which guides practitioners to consider *Reinforcing* with physical barriers only after evaluating other adaptation options.

Credits in GSH **Category 1: Shoreline Processes** incentivize minimizing the amount of hard armouring structures by: rewarding the absence of shoreline protection structures (**Credit 1.1**), removing existing structures (**Credit 1.3 and 1.4**), and utilizing nature-based methods as initial *Reinforce* options wherever possible (**Credit 1.5**). Projects can still receive points with the Green Shores framework while utilizing hard elements such as those of a hybrid design if needed due to site conditions.



Green to grey spectrum of shoreline approaches including natural to hardened shorelines figure created with support from Stewardship Centre for British Columbia, Green Shores, TransCoastal Adaptations Centre for Nature-Based Solutions, and Saint Mary's University.

Summary

The 5Rs framework for Nature-Based Coastal Adaptation (NBCA) introduces *Reimagine*, *Reserve*, *Relocate*, *Restore* and *Reinforce* adaptation options in a nested framework structure. One of the key points of the 5Rs framework is the importance of NBCA starting with *Reimagining* and proceeding to other “R” options and combinations, with *Reinforce* as a last resort. Green Shores promotes activities that align with the 5Rs concepts, such as, discussing shared shoreline values; creating policy and regulatory tools that support healthy shorelines; and protecting, enhancing, and restoring habitat. As a whole, the program offers best practices for and innovative examples of the types of NBCA options that are possible when we rethink our relationship to the coast.



The Admiral Tryon Boulevard site in BC is an example of a GSH hybrid design Reinforcing project using a buried revetment to protect against high wave energy and erosion from high tides and storms (8). Photo above shows site 3 years after Green Shores certification.

Further reading

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Appendix A: Examples of Green Shores Activities and Associated 5Rs Principles

Table A: Outlines example activities that are desirable within Green Shores principles and the 5R Framework for Nature-Based Coastal Adaptation (2); how these activities are promoted or supported by the Green Shores initiative through Green Shores for Homes (GSH), Green Shores for Shoreline Development (GSSD), Green Shores training, and Green Shores Local Government Groups; and which “R” concepts are related.

Example Activities	Green Shores Program	Relevant 5Rs Principles
Sharing information and educational resources	<ul style="list-style-type: none"> • GSH Credit Category 4: Shore Stewardship • Green Shores case studies and resources published online • Green Shores Level 1 and Level 2 training workshops • BC and NS Green Shores Local Government Groups 	Reimagine
Neighbors sharing docks	<ul style="list-style-type: none"> • GSH Credit 2.6: Overwater Structures 	Reimagine
Promoting shared private or public shoreline access	<ul style="list-style-type: none"> • GSH Credit 2.7 Access Design • GSSD Credit 2: Shore-Friendly Access 	Reimagine
Conservation covenant	<ul style="list-style-type: none"> • GSH Credit 4.2 Conservation Easement or Covenant 	Reimagine, Reserve
Regulatory tools (such as coastal protection zones and setbacks)	<ul style="list-style-type: none"> • BC and NS Green Shores Local Government Groups • GSH Credit 1.2: Setback/Impact Avoidance 	Reimagine, Reserve
Relocating existing buildings	<ul style="list-style-type: none"> • GSH Credit 1.6: Managed Retreat 	Reimagine, Reserve, Relocate
Following Green Shores principles and not utilizing hard-armouring elements	<ul style="list-style-type: none"> • GSSD Credit 5: Restoration/Enhancement of Aquatic Habitats • GSSD Credit 6: Enhanced Riparian Zone Protection • GSH Credit Category 2: Shoreline Habitats • GSH Credit 1.1: No Shoreline Protection Structures • GSH Credit 1.3: Hard Armour Removal • GSH Credit 1.4: Groin Removal • GSH Credit 1.5: Nature-Based Erosion and Flood Management 	Reimagine, Reserve, Restore
Following Green Shores principles and utilizing hard-armouring elements where necessary	<ul style="list-style-type: none"> • GSSD and GSH Credits stated in row above with the exception of GSH Credit 1.1: No Shoreline Protection Structures 	Reimagine, Reserve, Restore, Reinforce

Appendix B: 5R Actions Reflected in the Green Shores for Homes Framework

Table B: Outlines select suggested actions from the 5R Framework for Nature-Based Coastal Adaptation (2) that align with each of the *Rs*, and provides examples of how Green Shores activities promote or support these actions in the two guiding frameworks: Green Shores for Homes (GSH) and Green Shores for Shoreline Development (GSSD), through Green Shores training, or the Local Government Group.

R	Select Suggested Actions	Green Shores Examples
Reimagine	Rethink shorelines from private amenities to public goods	Green Shores Level 1 training: participants brainstorm key communal values and threats to shorelines using their personal experiences.
	Rethink shoreline management as shared responsibility	GSH Category 4: Shore Stewardship encompasses actions that shoreline landowners can take that support not only their own interests, but also public interests, whether they encompass environmental, recreational, educational, or aesthetic values.
Reserve	Policy tools, such as, keeping coastal land as natural spaces, government-subsidised buy-outs	Green Shores Local Government Groups encourages member municipalities to use policy or regulatory tools by creating a space for networking, collaboration, and knowledge sharing. The British Columbia Green Shores Local Government Group has supported the creation of resources for municipalities, such as the <i>Green Shores Policy and Regulatory Tools for Local Governments: A survey of shoreline management in bylaws, plans and policies</i> .
	Regulatory tools: implementing horizontal or vertical setbacks, requiring the allocation of land for conservation, etc.	
Relocate	Relocating, resettling, re-creating place in a sustainable location	GSH Credit 1.6: Managed Retreat– encourages property owners to move existing buildings that are at risk of shoreline erosion inland to minimize the need for shore protection and avoid negative impacts associated with managing erosion in a changing climate
Restore	Rethinking that ecosystems can be managed and supporting rewilding	GSH Credit 3.2: Reduce and Treat Runoff - supports naturalization through retaining areas with natural vegetation and reducing areas of lawn maintained by mowing. GSH Credit 3.5 awards points for eliminating the use of synthetic herbicides, pesticides, or fertilizers in routine landscape maintenance.
	Remediating contaminated sites	GSH Credit 3.4 incentivizes the removal of creosote material, which is toxic to marine and freshwater organisms. GSSD Credit 3: Re-Development of Contaminated Sites supports actions to reverse environmental impacts at contaminated sites and reduce pressure on undeveloped land.
Reinforce	Redesign with some elements of hard engineering as a last resort when a line of defense is needed to protect important human activities	GSH Credit 1.5 promotes using soft or hybrid nature-based methods of shoreline protection where appropriate, and provides information for when utilizing hard armouring may be appropriate.