

Design Guidelines for Nature-Based Solutions for B.C. Flood Infrastructure

Background

Engagement related to the [B.C. Flood Strategy](#) demonstrated a growing interest in Nature-Based Solutions (NbS) to manage coastal and riverine flooding, as well as erosion risks. These solutions mimic natural processes and provide environmental and societal benefits¹.

In the Protect, Accommodate, Retreat/Managed Retreat, and Avoid (PARA) framework for managing flood risks, "Protection" refers to strategies that shield existing activities, property, and infrastructure from hazards while keeping the current conditions unchanged. This often involves measures like redirecting floodwaters or preventing erosion with hard structures such as seawalls, rip rap, and dikes², which historically have been the focus of Provincial flood infrastructure guidelines.

Action 2.7 of the B.C. Flood Strategy seeks to enhance the accessibility and utility of provincial technical guidance. A crucial component of this is the creation of the "Design Guidelines for Nature-Based Solutions for B.C. Flood Infrastructure," which will be developed to improve the design and effectiveness of flood infrastructure in British Columbia by incorporating nature-based solutions (NbS). To prepare for engagement on the development of the guidelines, WLRS has worked with Kerr Wood Leidal Associates Ltd., a professional engineering consultant, and Sky Spirit Studio Inc., a firm specializing in Indigenous design. They created preliminary materials and examples to help guide discussions.

¹ Vouk, I., Pilechi, V., Provan, M., & Murphy, E. (2021). Nature-Based Solutions for Coastal and Riverine Flood and Erosion Risk Management. Canadian Standards Association.

² Parnham, H. (2023) [managed] retreat: the elephant in the adaptation framework. Prepared for CLIMAtlantic by DV8 Consulting.

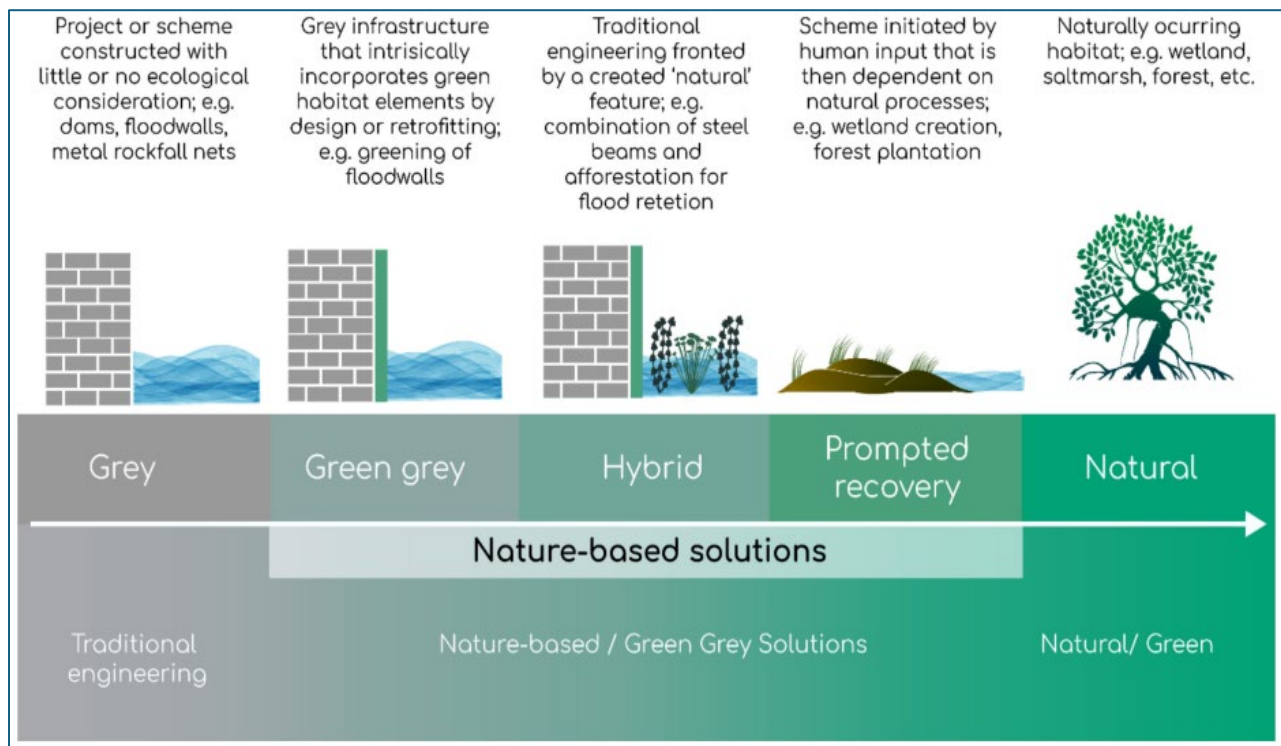
Draft Scope for Guidelines

NbS that provide coastal and riverine flood and erosion protection benefits that:

1. can be integrated with a dike (constructed on a dike itself), or near a dike, and/or
2. can be separate from, or be an alternative to, a dike.

It will complement or offer alternatives to existing Provincial design and construction guidelines for flood protection infrastructure. Instead of being a detailed technical design document, it provides a framework for planning, designing, and constructing coastal and riverine projects at a site-specific or regional scale, considering physical, ecological, and cultural factors.

These guidelines will consider a range of NbS for flood and erosion protection projects including "green-grey" hybrid infrastructure and "green" natural systems, as illustrated in the NbS graphic figure below.



Grey to green continuum (Martin, Scolobig, Linnerooth-Bayer, Liu, & Balsiger, 2021).



Target Audience / User Groups

The target audiences for the NbS design guidelines are, as follows:

Dike Owners & Diking Authorities

The intent of the guidelines is to offer an overview of how to use NbS with diking infrastructure, including the processes and considerations involved. They will help dike owners and Diking Authorities, often local governments or regional districts, consider NbS for flood and erosion protection and understand the steps for design, construction, and maintenance. Additionally, the guidelines will provide resources for planning and scoping projects with NbS, including setting project goals, performance levels, baseline assessments, regulatory requirements, risk management, and post-construction planning.

First Nations


These guidelines can be used alongside Indigenous Knowledge systems to develop solutions that meet community needs. They will offer an overview of various Western NbS that can be referenced for planning, scoping, and implementing flood protection, in conjunction with Indigenous approaches.

Regulatory Bodies

Regulators can use these guidelines to understand how NbS will fit with overall dike infrastructure. The high-level NbS solutions discussed may be considered by regulatory bodies in future watershed and ecosystem planning. The guidelines will outline a process for assessing and incorporating NbS along dikes, and design professionals and regulators may use the provided approach and checklists to prepare and review applications for integrating NbS into dike projects.

Design Professionals

The guidelines will outline NbS that can be used with or instead of traditional hard grey infrastructure for flood and erosion protection. This will include techniques and case studies to help design practitioners with baseline assessments, selecting and designing solutions, and addressing implementation, operations, maintenance, and monitoring. These guidelines are intended to complement, not duplicate, existing detailed design guidance for certain NbS. Where more detailed guidance is available, key references will be provided for practitioners to consult



for in-depth design solutions. Design professionals should use the recommended process, checklists, and other considerations for assessing and developing NbS and preparing submissions for review by the Inspector of Dikes.

Indigenous Partnership

In line with the Province's commitment to the *B.C. Declaration on the Rights of Indigenous Peoples Act* (the Declaration Act) and the *United Nations Declaration on the Rights of Indigenous Peoples Act* (the UN Declaration), particularly Articles 19³ and 29⁴, these guidelines aim to foster understanding of Rights and Title, and promote relationship building with First Nations and Indigenous organizations. The goal is to encourage shared information, transparency and support collaborative decision-making with entities, such as local governments.

The guidelines will seek to have First Nations and Indigenous perspectives woven throughout to assist practitioners to understand how Indigenous Knowledge systems and ongoing land management have led and continue to support watershed and coastal landscape flood protection.

The use of NbS should be informed by both Indigenous and Western/settler knowledge while respecting Knowledge-Keepers and ensuring that shared information is not appropriated. Without collaboration with Indigenous communities, implementing NbS on dikes risks perpetuating colonialism, which has historically excluded Indigenous environmental stewardship knowledge. There are concerns that NbS could commodify Traditional Indigenous Knowledge or reinforce existing power imbalances⁵, worsening the climate and biodiversity crisis⁶. Indigenous Knowledge is crucial for developing local solutions that benefit both people and ecosystems.

³ States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them.

⁴ Indigenous peoples have the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources.

⁵ Rees (2023). Unsettling NbS: A pathway towards shifting colonial power relations in nature-based solutions research and practice

⁶ Pham, N., Gilbertson, T., Witchger, J., Soto-Dansec, E., & Goldtooth, T. (2022). Nature-Based Solutions 0 Indigenous Environmental Network Climate Justice Program Series. Indigenous Environmental Network. Retrieved July 27, 2023, from <https://www.ienearth.org/nature-based-solutions/>



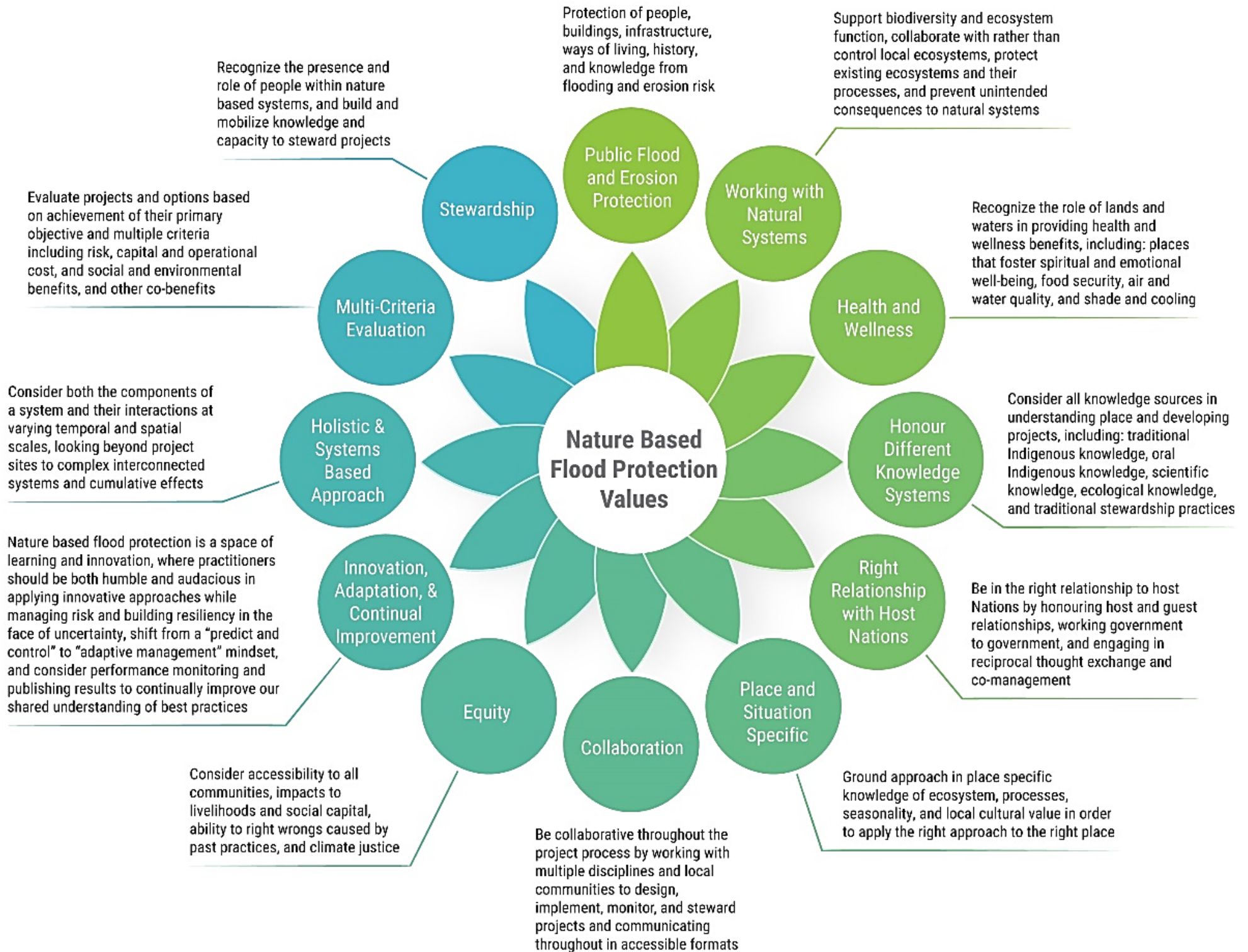
Indigenous Design

An essential collaborator is Sky Spirit Studio Inc., an Indigenous design practice. As an important first step, Sky Spirit led the guidelines team to improve awareness by educating, informing, and advising on Indigenous World Views, the importance of centering the Host Nations, and thoughts on decolonizing history, design, and policy. Sky Spirit shared their perspectives on Indigenous design and themes important to the Indigenous worldview.

To set the foundation for the development of this document, Sky Spirit facilitated two Decolonization and Design workshops with members of the WLRS and Kerr Wood Leidal team. The workshops focused on Indigenous world views, Coast Salish Climate Adaptive Solutions and Environmental Stewardship, decolonizing design, colonial history, and its impacts on current thought and design processes—particularly subconscious bias that can stonewall innovative Indigenous solutions and experience. Following these workshops, members of WLRS and the Kerr Wood Leidal team collaborated to identify the following proposed project values as being foundational to this work.

Proposed Values of Design Guideline for NbS Solutions for B.C. Flood Infrastructure

For discussion, the Nature Based Flood Protection Values graphic below summarizes the proposed values for NbS flood and erosion protection projects in British Columbia. These values were developed in collaboration with Sky Spirit, Kerr Wood Leidal, and WLRS.





Proposed Guidelines Roadmap

The roadmap below outlines the Design Guidelines for Nature-Based Solutions to flood infrastructure in B.C. Use this as a general guide for planning and implementing projects. For more details on requirements, considerations, and resources, see the chapters in the guideline.

Planning & Baseline Assessments

- Confirm project goals and constraints, including Indigenous perspectives
- Confirm high-level regulatory and permitting requirements and timeline
- Develop and initiate engagement plan for Indigenous Nations and local community
- Complete baseline assessments: flood hazards, environmental, archaeological (detailed assessments may be deferred to next stage)

Key Outcomes: project goals, permitting requirements, site understanding, and initiated engagement plan

Conceptual Options Development and Evaluation

- Develop flood and erosion mitigation options considering full suite of potential approaches
- Evaluate options considering project objectives, flood and erosion protection performance/risk, lifecycle costs, First Nations and community engagement, and environmental and social factors

Key Outcomes: selected flood and erosion protection option

Preliminary and Detailed Design

- Complete project design considering current best practices, active research, systems approach, site-specific considerations, traditional Indigenous Knowledge, and risk management
- Complete required permitting based on design
- Develop draft operations and maintenance plan, considering adaptive management approaches and performance monitoring

Key Outcomes: design report and drawings, permitting and approvals, technical specifications, costs



Implementation and Construction

- Construction plans: environmental protection, safety, vegetation management, care of water, field review
- Complete ongoing construction review, record survey, completion report, and record drawings
- Where possible, engage Indigenous communities and business to be involved with the implementation and construction work

Key Outcomes: construction package (specifications, drawings), completion report and record drawings

Maintenance, Monitoring, and Evaluation

- Finalize operations and maintenance plan at construction completion, including resources for ongoing work
- Complete ongoing vegetation management during establishment period
- Complete annual condition inspections at a minimum and consider additional monitoring to assess effectiveness and inform future projects. Incorporate Indigenous communities in the monitoring process.
- Evaluate the project success and shortcomings, including Indigenous perspectives.

Key Outcomes: annual inspection report and record of maintenance activities

Optional Outcome: recurring monitoring reports with summary of lessons learned and performance effectiveness

This guideline will also be supported by select project case studies, to best-demonstrate the techniques highlighted, including local projects, and projects with Indigenous collaboration.