

Step 5 – Taking Action

Give the River Space



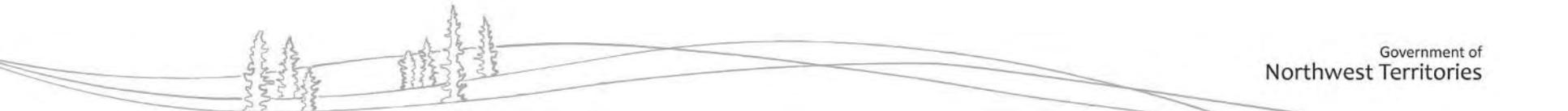


Community Land Use Planning Taking Action - Giving the River Space

NWTAC – Riverbank Erosion Workshop

December 3, 2025

Government of
Northwest Territories



Introductions

Chris Hewitt, RPP, MCIP
Manager, Community Planning
Community Governance
Division, MACA

- **Presentation Overview**
- Where We Live Why We Plan
- Community plans and slope instability
- Non-Structural Mitigation
- Taking Action

Where We Live Why We Plan

- NWT community governments have the authority to regulate land use and development using land management tools and practices, within their community boundaries
- **Managing human activities and climate change**



The Community plan and slope instability

- **purpose of a community plan** is to provide a policy framework to guide the physical development of a community
- Climate change considerations
- A community plan **must** contain statements of policy respecting **the management of any environmentally sensitive lands or lands subject to natural hazards such as flood or slope instability.**



Non-Structural Mitigation(non-physical)

- Restricting or limiting development in high-risk erosion areas is a **non-structural measure**.
- This may involve designating environmentally sensitive land use areas and policies that restrict new construction. And transition buildings away over time
 - reduce exposure and vulnerability to hazards without relying on engineered structures.
 - Public education and engagement

Taking Action & Status of Plans

- **Updated plans** inform development and land decisions,
 - include the redevelopment of areas over time,
 - Land use designations along river maintain buffer
 - Setback requirements from top of bank (40m setback Nahanni Butte)
 - Considerations for Planned Relocation

Common Actions in plan Implementation

- Managing community drainage, revegetation, no removal, and snow piling concerns in areas along riverbanks or shorelines



Town of Fort Smith

COMMUNITY PLAN

March 2025



Northwest Territories

Status of plans Under Review

- Village of Fort Simpson
- Town of Inuvik
- Hamlet of Fort Providence
- Fort McPherson
- Gameti
- Jean Marie River
- Kasho Got'ine(Fort Good Hope)
- Samba K'e
- Hay River
- Tuktoyaktuk



Naha Dene Band Land Use Plan

Protected Riverbank and Slope Policies (red area)

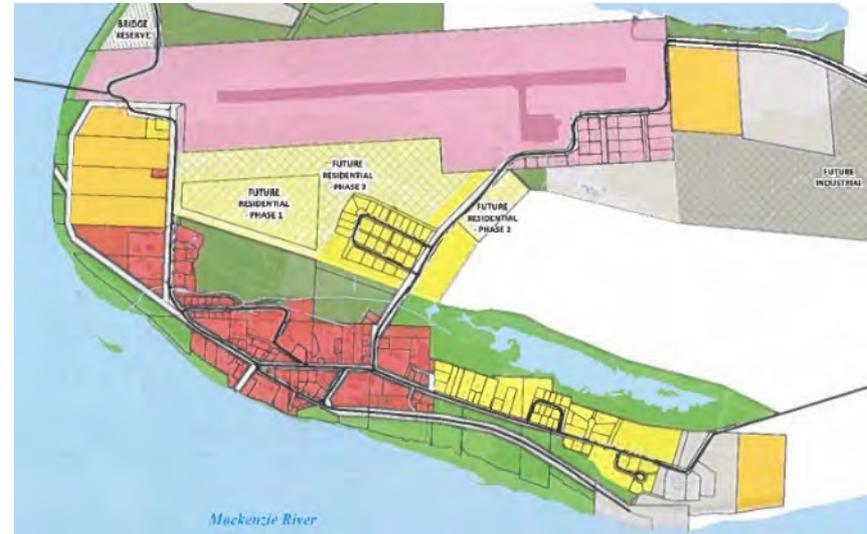
- No structures will be permitted to be developed within 40m of the riverbank (minimize erosion)
- Existing vegetation along riverbank and on slopes will be preserved, and where appropriate, revegetation will be encouraged to protect from erosion

Figure 1: Nahanni Butte Land Use Areas



Hamlet of Tulita Community Plan and Zoning Bylaw

Environmentally Sensitive – areas of known hazards , not suitable for development due to flood risk and erosion development not supported (Community plan and zoning bylaw)



Town of Fort Smith ESA Policies

- Protect ESA's and minimize danger to people and property due to riverbank slope failure.
- **ESA Environmentally sensitive areas**
- Allow for land use activities that do not negatively impact ESA's
- Reduce environmental risks in flood-prone and erosion-prone areas.





Mársı | Kinanāskomitin | Thank you | Merci | Haǵ' | Quana |
Qujannamiik | Quyanainni | Máhsı | Máhsı | Mahsì

Step 5 – Taking Action

Give the River Space

Robin McKillop

Principal Geomorphologist, Climate Resilience Lead

SLR Consulting



How much space does a river need?...



- “**Freedom space**” is a river management concept that refers to the natural, unrestricted area a river needs to flow, flood, change course, and perform ecological functions without human interference
- Why?
 - Risk management
 - River health
 - Economic benefit
 - Climate resilience
- Need to consider **unconfined** vs. **confined** systems...

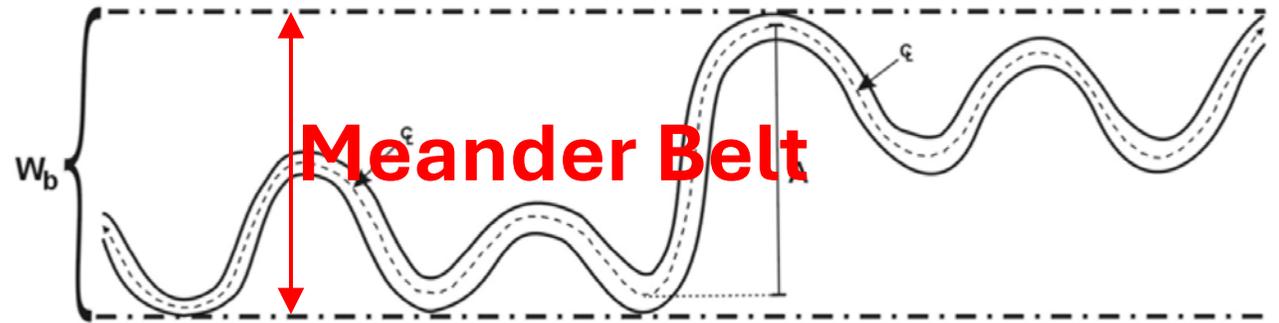


How much space does a river need?...

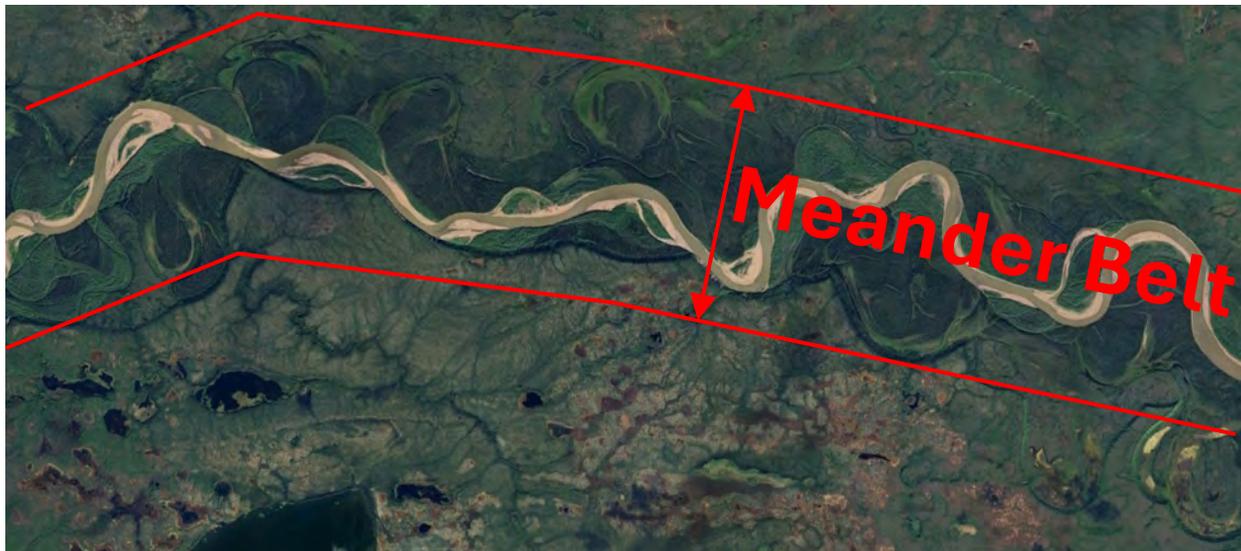
Unconfined Systems



- Meander belt – the corridor within which river bends migrate over time
- Less common setting for communities in NWT



Parish Geomorphoc (2004)

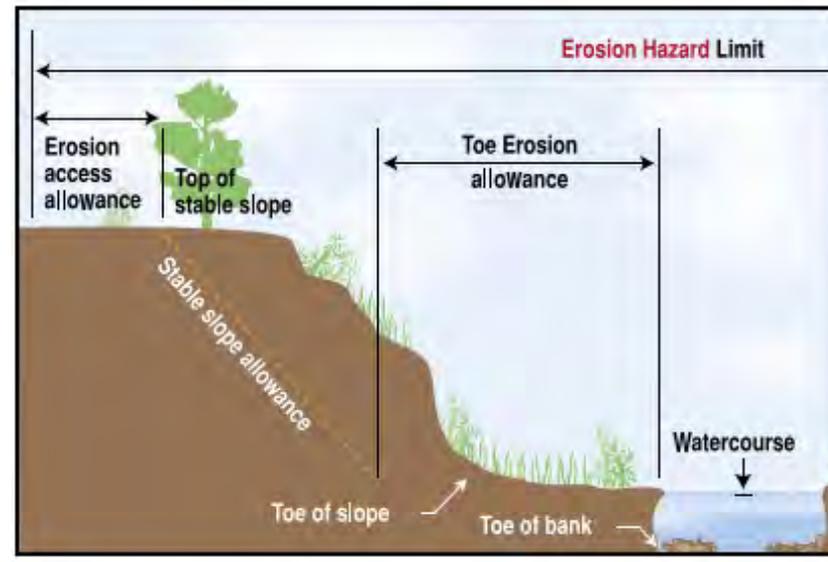


How much space does a river need?...

Confined Systems



- Allowance for...
 - **Toe erosion**
 - **Slope instability**
 - Permafrost thaw
- More common setting for communities in NWT



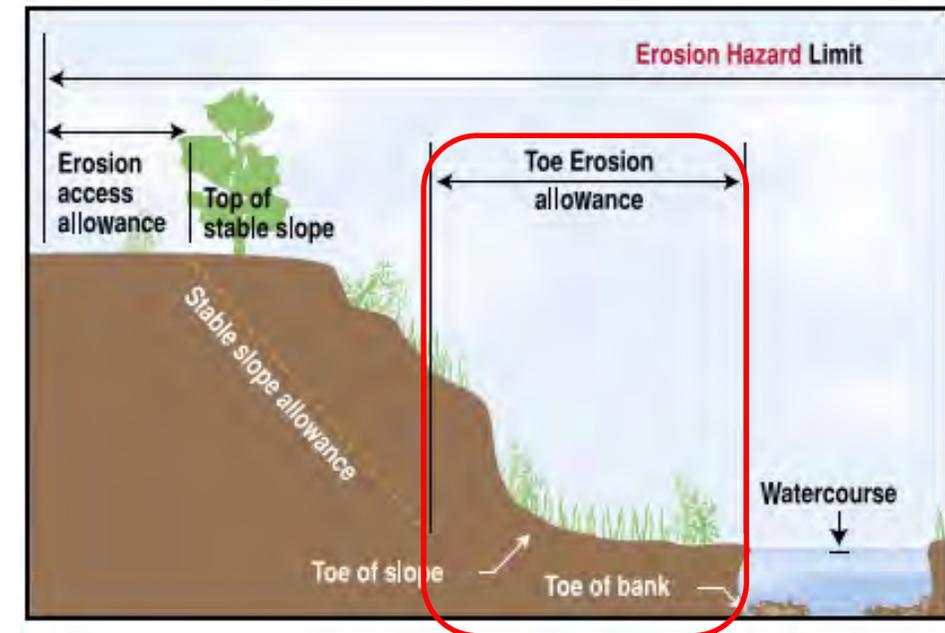
Ontario Erosion Hazard Limit Guidelines (MNR, 2002)



Toe erosion allowance



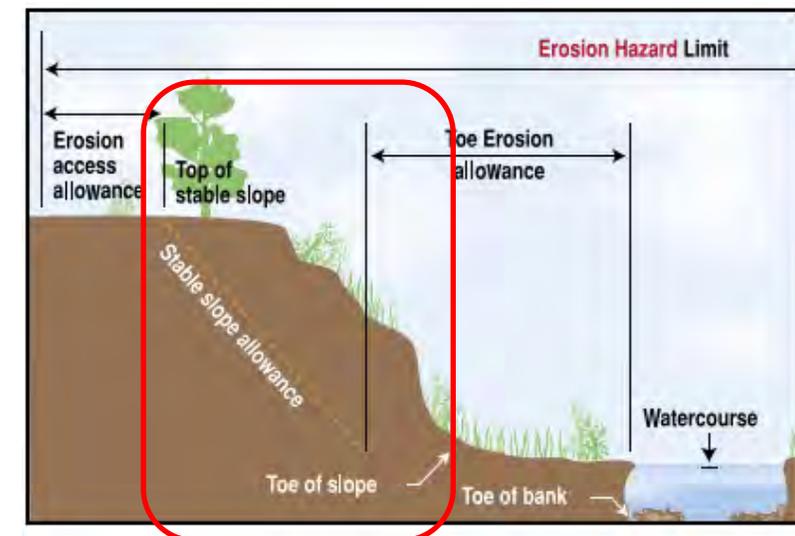
- 50-100 year timeframe?
- Based on trend analysis or monitoring
- If we install erosion control measures, can we disregard the toe erosion allowance when considering hazard limits?



Stable slope allowance



- Setback that allows for a slope to gradually become gentler until it reaches its “long-term stable slope angle”
 - Account for permafrost conditions!
- Initial (conservative) assumption before detailed information available: 3-5H:1V?
- Site-specific geotechnical investigation and slope stability analysis improve accuracy
- Assumes no measures taken to stabilize the slope



Nature-Based Solutions for River Flooding and Erosion Risk Management

NWT Riverbank Erosion Workshop

December 2-4, 2025

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National Research
Council Canada

Conseil national de
recherches Canada

Canada

Nature-Based Solutions – Background

Nature-Based Solutions for Flood and Erosion Risk Management:

Strategies or measures that depend on, or mimic, natural system processes to provide flood and erosion risk management functions, while delivering environmental and other societal co-benefits (Vouk et al., 2021)

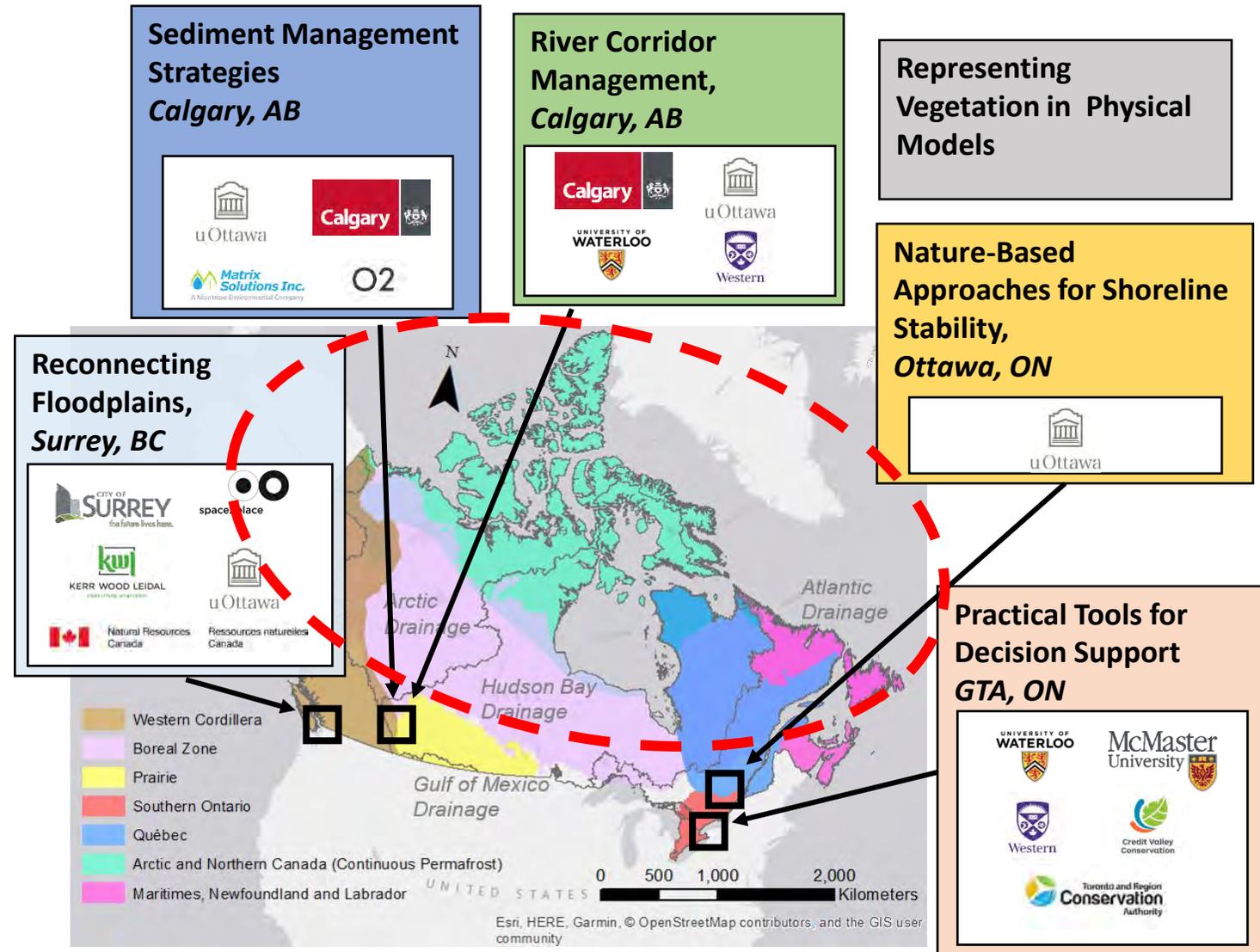
Potential Benefits



- NbS rely on natural processes and features present in the region of interest (not all NbS include vegetation!)
- Hazard avoidance and preserving natural spaces is considered a nature-based solution (i.e. providing “room for the river”)

Riverine NbS Project at NRC-OCRE

- Since 2021, NRC-OCRE has been partnering and collaborating with many organizations to support NbS pilot projects in different parts of Canada
- Lessons learned from the pilot projects are being integrated into a new Canadian guideline for NbS design and implementation
- Northern Canada is currently not represented in our collection of NbS pilot projects
- We want to ensure that future editions of the guideline capture the **unique challenges and considerations of working in northern Canada and cold regions**
 - Integrate lessons from existing case studies
 - Collaborate on future projects where natural features/process are being considered



Riverine NbS Project Example: Bow River Gravel Bar Realignment

Challenge:

The 2013 flood event deposited a large volume of sediment in the vicinity of the 10th Street Bridge. The gravel bars are restricting flow, elevating flood risk.

Conventional engineering approaches (e.g. dredging) can harm riverine habitats and disrupt the natural sediment balance

Objective

The City is exploring a bar realignment approach with objectives to:

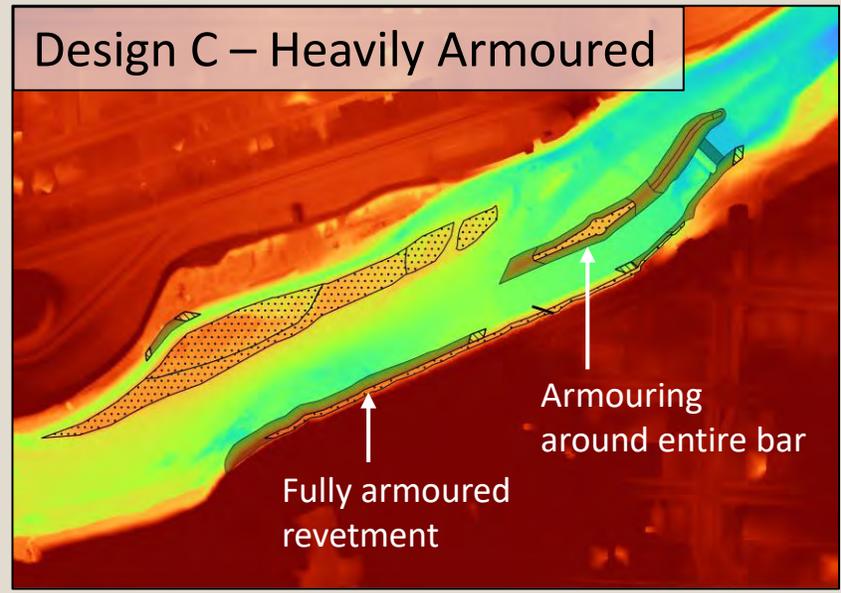
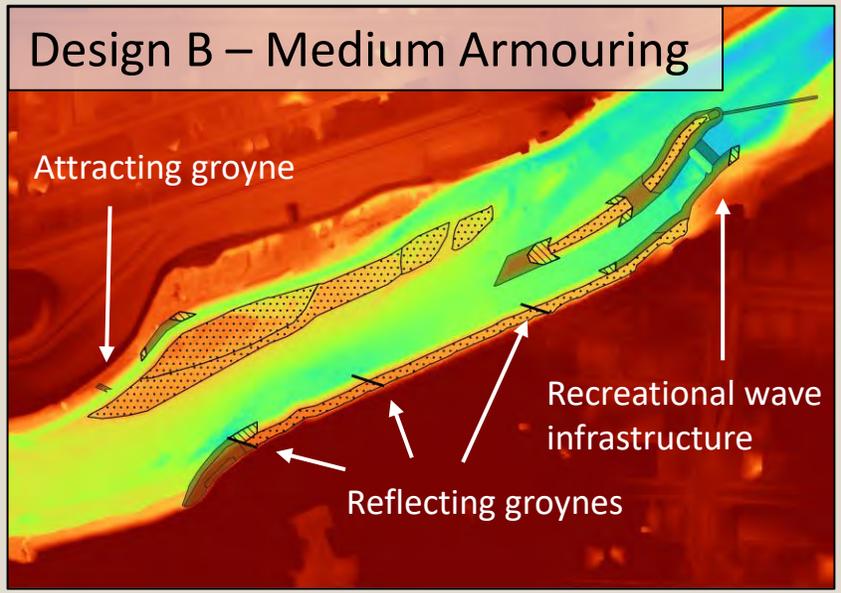
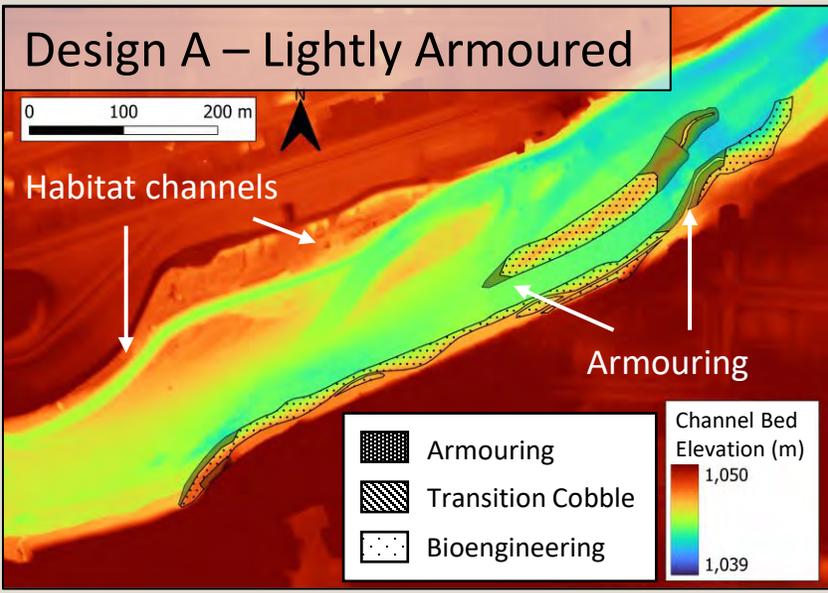
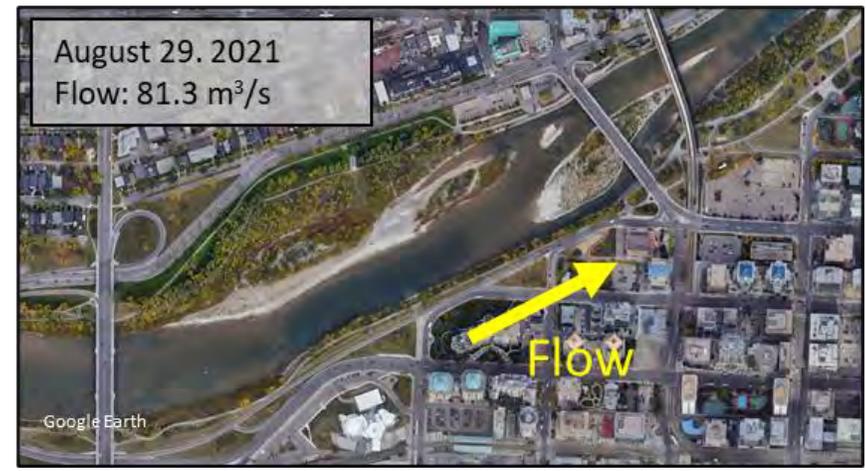
- Reduce the blockage and flood hazard
- Minimize impacts to habitat and geomorphic processes
- Enhance recreation and habitat where possible



Riverine NbS Project Example: Bow River Gravel Bar Realignment

Conceptual Designs

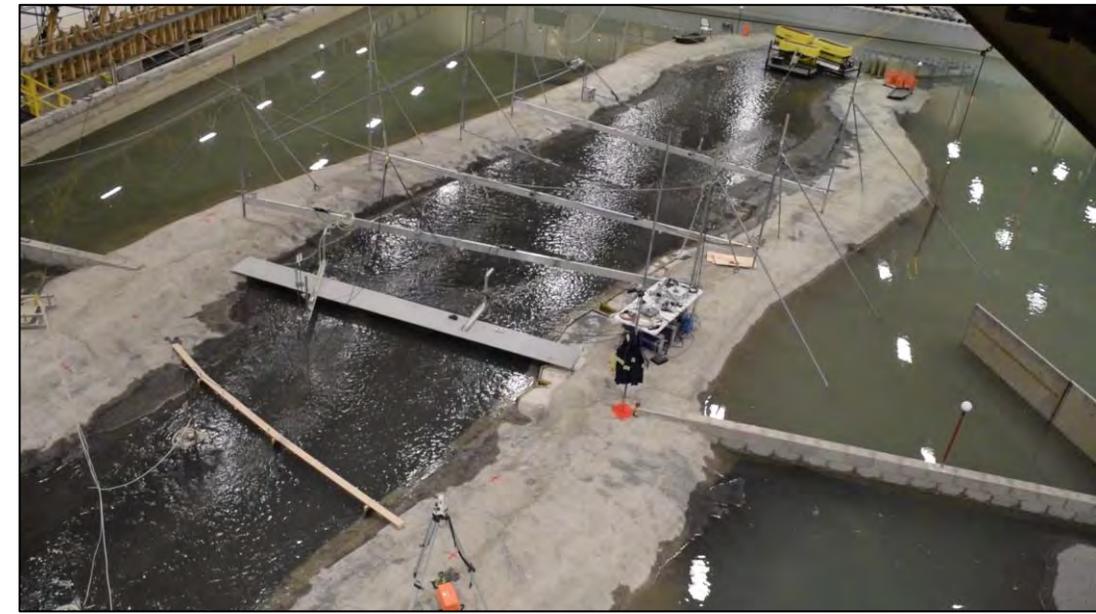
- Three conceptual designs were drafted for the City of Calgary by a consultant (Matrix Solutions)
- Each design involves “thinning” the main gravel bar as well as various amounts of rip-rap armouring



Riverine NbS Project Example: Bow River Gravel Bar Realignment

Physical Modelling

- NRC-OCRE constructed a physical laboratory model to study the performance of each conceptual design
- The results were shared with the City of Calgary and Matrix Solutions to help them optimize their design
- Key Questions
 - Where can we expect to see sediment erosion/deposition?
 - How will the riverbed change if a small, medium, or large flood were to occur?



Bow River 1:30 scale model

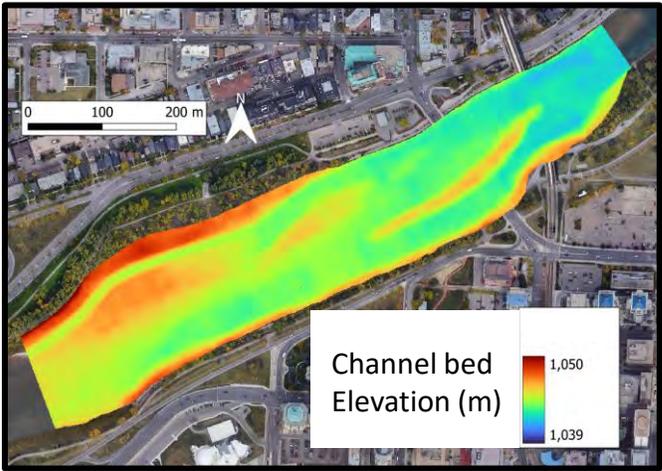


Model Construction Photos

Riverine NbS Project Example: Bow River Gravel Bar Realignment

Example of Physical Modelling Results for Conceptual Design A

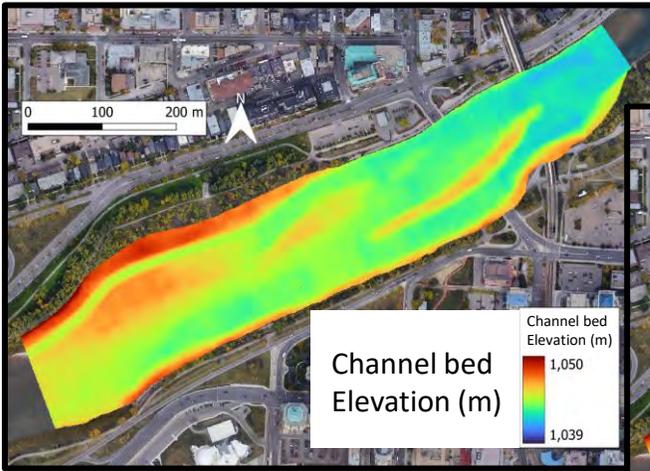
Conceptual Design A



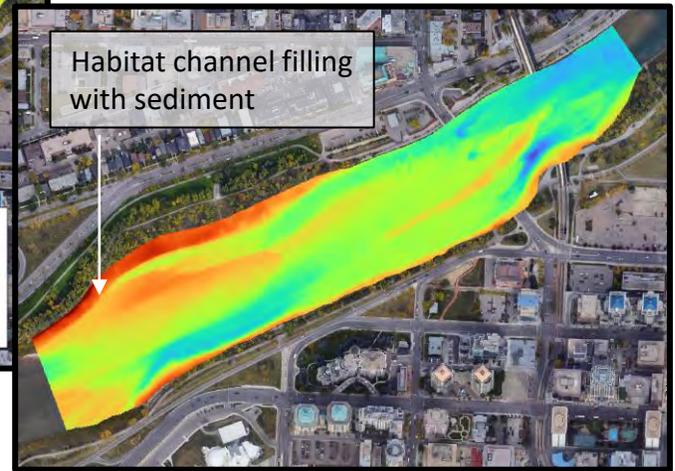
Riverine NbS Project Example: Bow River Gravel Bar Realignment

Example of Physical Modelling Results for Conceptual Design A

Conceptual Design A



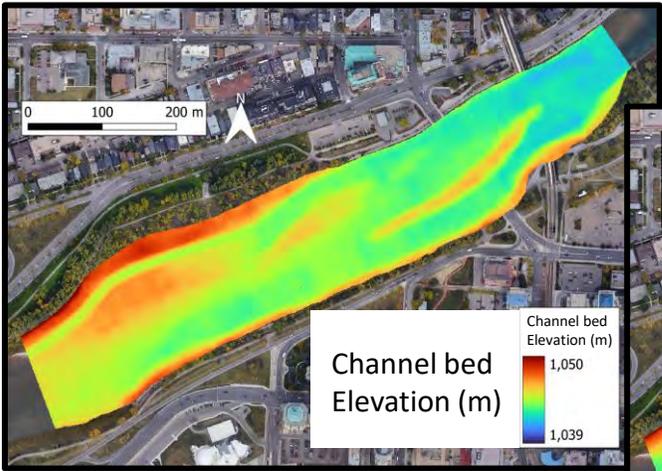
After 10-Year Flood



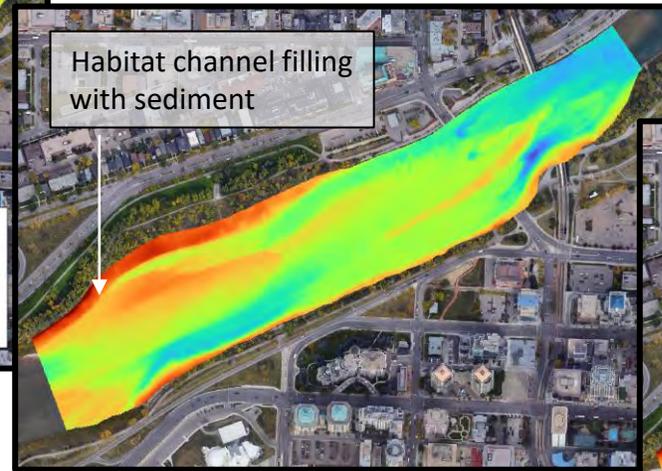
Riverine NbS Project Example: Bow River Gravel Bar Realignment

Example of Physical Modelling Results for Conceptual Design A

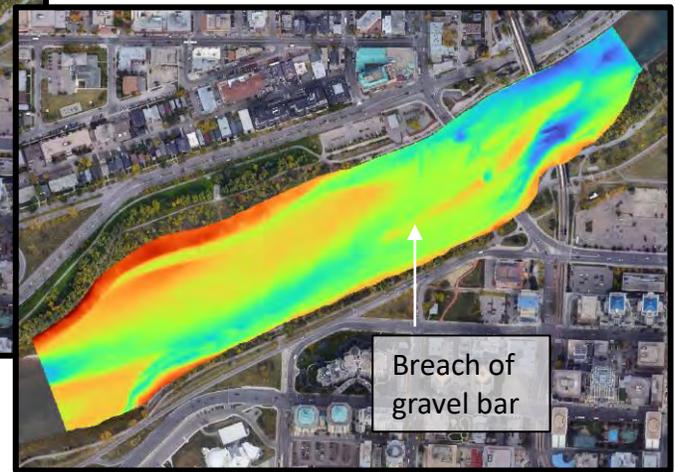
Conceptual Design A



After 10-Year Flood



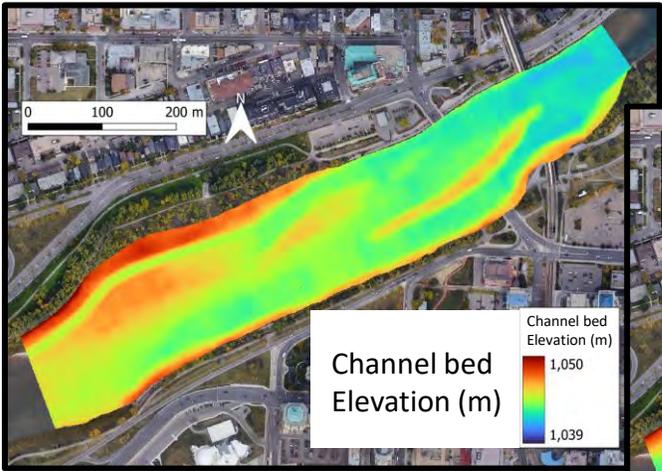
After 10- and 35-Year Flood



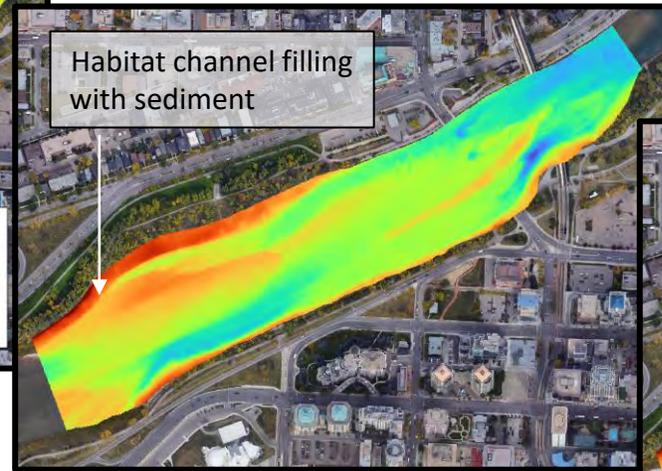
Riverine NbS Project Example: Bow River Gravel Bar Realignment

Example of Physical Modelling Results for Conceptual Design A

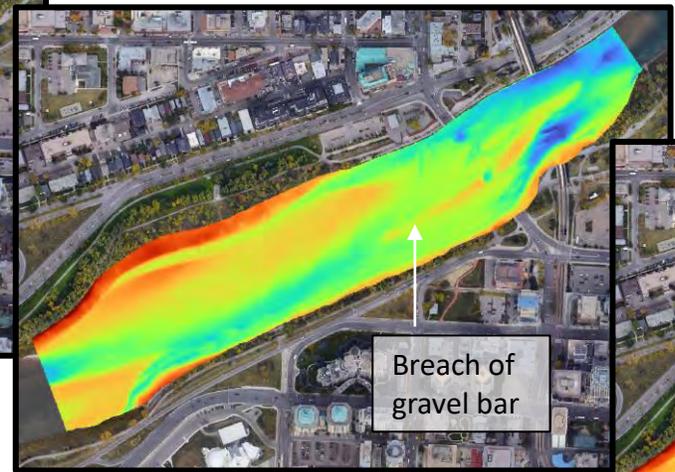
Conceptual Design A



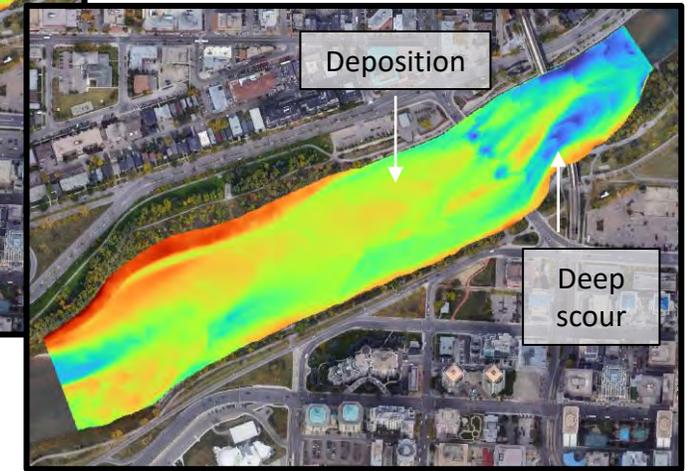
After 10-Year Flood



After 10- and 35-Year Flood



After 10-, 35-, and 100-Year Flood



Riverine NbS Project Example: Bow River Gravel Bar Realignment

The physical modelling results were provided to the City of Calgary and their consultants to help them assess the performance of their conceptual designs make improvements.

A preliminary site plan has been drafted and construction is anticipated to commence in 2027, pending funding and approvals



Coastal NbS Project Example: Boundary Bay Living Dyke

Challenge and Objectives:

- The City of Surrey, City of Delta, and Semiahmoo First Nation are collaborating to investigate coastal NbS to combat climate change and sea level rise
- Exploring a “Living Dyke” approach that includes dyke upgrades and salt marsh planting to attenuate wave energy



City of Surrey (2025)



Coastal NbS Project Example: Boundary Bay Living Dyke

Approach:

- Vegetation is a key component of the “living dyke” concept, but vegetation requires suitable time and conditions to grow
- The project team has established a “pilot site” to test different techniques to protect vegetation so that it can grow and become established
- Tested wave protection strategies:
 - Oyster shells in biodegradable bags
 - Brushwood dams
 - Cobble berms
- Prior to field test, some preliminary laboratory testing was conducted at the NRC-OCRE lab

Photos courtesy of Allison Matfin



Oyster shell tests at NRC



Boundary Bay Pilot Site

Coastal NbS Project Example: Boundary Bay Living Dyke

Outcomes:

- Lessons from the Boundary Bay pilot site will be used to inform the final design and construction of the Living Dyke in Surrey



City of Surrey (2025)

Considerations for the NWT Riverbank Erosion Workshop

Questions to Consider:

- What could a nature based solution look like in your area?
- Are nature-based solutions applicable for your area?
- How do natural features in your area (rock, sediment, vegetation, woody debris, permafrost) influence flow and erosion? How do flow and erosion influence these natural features?

Nature-Based Solutions for River Flooding and Erosion Risk Management

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Thank You

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Ocean, Coastal and River Engineering