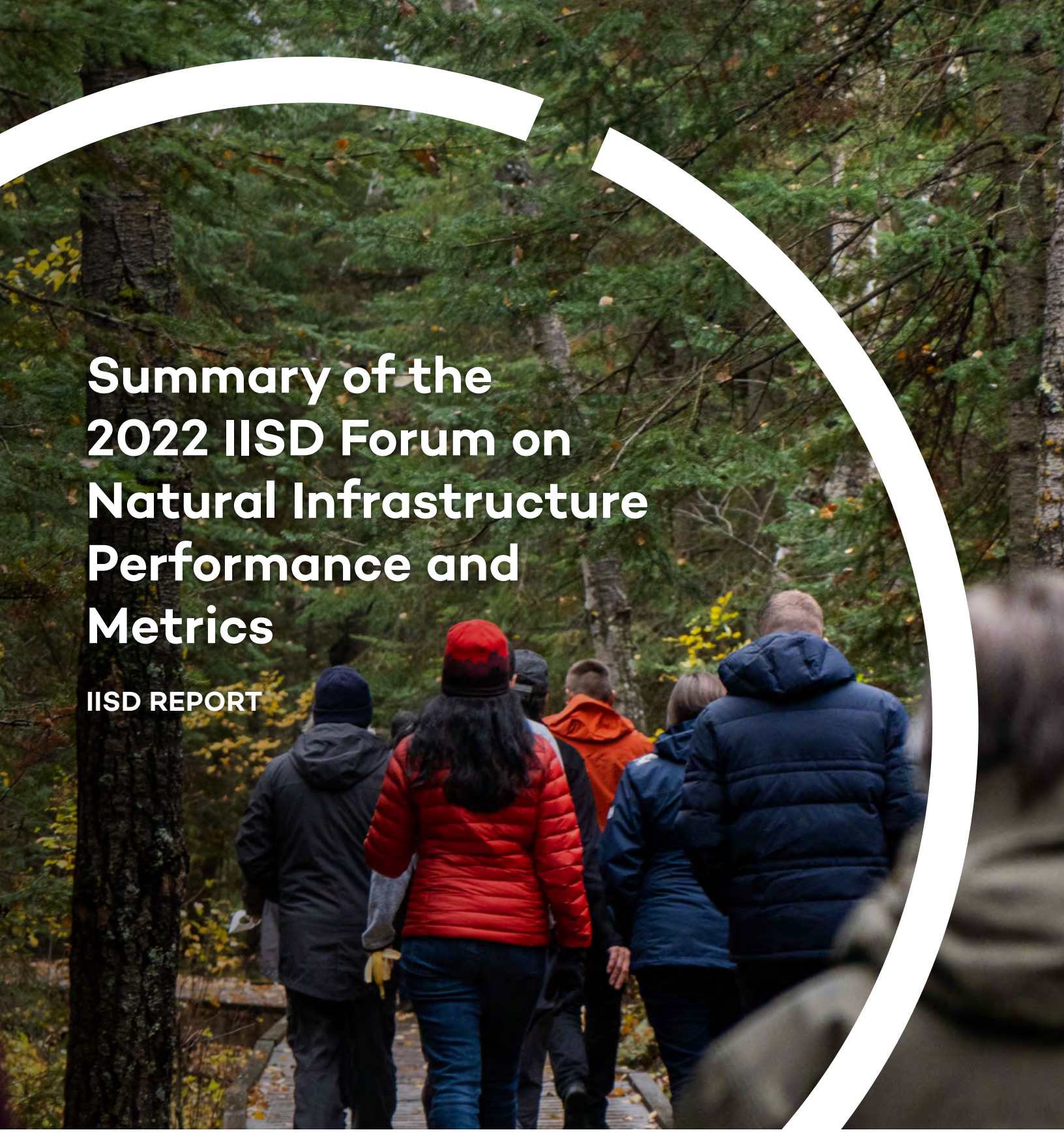

Summary of the 2022 IISD Forum on Natural Infrastructure Performance and Metrics

IISD REPORT

IISD | Natural Infrastructure for Water Solutions

Joey Simoes
Josée Méthot
Ashley Rawluk

June 2023

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) is an award-winning independent think tank working to accelerate solutions for a stable climate, sustainable resource management, and fair economies. Our work inspires better decisions and sparks meaningful action to help people and the planet thrive. We shine a light on what can be achieved when governments, businesses, non-profits, and communities come together. IISD's staff of more than 200 people, plus over 150 associates and consultants, come from across the globe and from many disciplines. With offices in Winnipeg, Geneva, Ottawa, and Toronto, our work affects lives in nearly 100 countries.

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Natural Infrastructure for Water Solutions

Natural Infrastructure for Water Solutions (NIWS) is a 5-year initiative (2022 to 2026) led by IISD to scale up NI across the Canadian prairies (Manitoba, Saskatchewan, and Alberta). The NIWS initiative aims for natural infrastructure to be well-understood, adopted, financed, and enabled by policy.

While science and policy are the foundation for this work, IISD is also taking a systems view—looking for opportunities and creative approaches to achieve real impact across the region, working with a network of champions, partners, and decision-makers.

Summary of the 2022 IISD Forum on Natural Infrastructure Performance and Metrics

June 2023

Written by Joey Simoes, Josée Méthot, and Ashley Rawluk

IISD's Natural Infrastructure for Water Solutions (NIWS) initiative is funded by the BHP Foundation

BHP | Foundation

Indigenous Lands and Cultures

"Indigenous Peoples are rights holders with robust historical, cultural, and spiritual knowledge and connection to their traditional lands and with jurisdiction over their territories" (Tozer et al., 2022, p. 26).

The region we refer to as the Canadian Prairies is home to incredibly diverse Indigenous lands and cultures, including the Indigenous territories of the Cree, Assiniboine, Salteaux, Lakota, Dakota, Anishinaabe, Ojibwe, Oji-Cree, Blackfoot, Nakota Sioux, Iroquois Tsuut'ina, Stoney Nakoda, and the homeland of the Métis Nation.

With careful consideration and collaboration, natural infrastructure can be an important part of reconciliation and an opportunity to support the United Nations Declaration on the Rights of Indigenous Peoples.

Executive Summary

Natural infrastructure (NI) is essential for water management across the Canadian Prairies and supports the resilience of communities and ecosystems. However, while there is growing recognition of the importance of NI for meeting Canada's water-related infrastructure outcomes, there is a need to build a better business case for NI by raising awareness of benefits and co-benefits, marshalling the evidence base in the Canadian context, and equipping key stakeholders with the guidance they need to champion, implement, and evaluate NI projects.

On October 12 and 13, 2022, the International Institute for Sustainable Development (IISD) hosted the **Forum on Natural Infrastructure Performance and Metrics** in Winnipeg, Manitoba, Canada. This forum brought together leading experts and practitioners working to advance NI and nature-based solutions, with a focus on the Canadian Prairies. Together, participants discussed key challenges, opportunities, and technical considerations related to building a better business case for water-related NI across Canada's Prairies. Participants included funders of NI, scientists and researchers, watershed groups, different levels of government (local, provincial, federal), and Indigenous Peoples, among others.

Day 1 of the 2-day forum included presentations, discussions, and breakout sessions related to advancing our collective understanding of the business case for NI solutions and how to deliver at a scale appropriate to the existing and future water challenges on the Prairies. Day 2 continued on the road, visiting NI and hybrid infrastructure sites in Southern Manitoba, including the Ste. Geneviève retention pond, Grand Marais Lagoon, Brokenhead Wetland Ecological Reserve, Red River Floodway, and several urban sites within Winnipeg, including the John Hirsch Place soil cells, Human Rights Museum green roof, Sage Creek naturalized stormwater ponds, and East St. Paul floating treatment wetlands. At each site, attendees learned about their function and the metrics used to understand and evaluate performance.

Key Insights From the Forum

Across the Canadian Prairies, NI can help meet the growing water-related infrastructure gap in areas including water treatment (e.g., stormwater, wastewater), water supply, flood protection, and drought mitigation, among others. NI also provides important social, economic, and environmental co-benefits (e.g., carbon sequestration, urban heat reduction) that are critical in the face of climate change and for regional resilience. While there is growing momentum for NI in Canada—driven by supportive policy (e.g., development of National Adaptation Strategy), public investment, and local efforts—awareness of NI is generally at an early stage and more must be done to champion the role of NI as a viable infrastructure option on Canada's Prairies.

Box ES1 provides a summary of the most significant findings and actions suggested by participants of the forum to strengthen the business case for NI and, ultimately, to accelerate the adoption of NI across Canada's Prairies.

Box ES1. Next steps for NI Adoption across the Prairies

DATA AND KNOWLEDGE

Focus on metrics that matter to decision-makers ("Tell the story"):

A better business case for NI will require metrics, data, and communications tailored to the needs of different audiences, packaged in a way that tells a compelling story. Understanding the information needs of key audiences, including funders, policy-makers, local decision-makers, and NI professionals (e.g., engineers, municipal planners, and asset managers) is essential. There can be important trade-offs between the rigour and accuracy of metrics on the one hand and practicality and usability on the other. For example, the metrics that decision-makers or funding program use are often different than those used by researchers. For local communities, there is a growing interest in the risk-reduction benefits of NI, alongside an interest in practical metrics related to implementation (e.g., cost, maintenance, etc.).

Invest in data and shared platforms ("Leverage data"):

There are significant opportunities to collect and share data to inform NI design, implementation, and evaluation. Natural asset inventories need to be developed, and NI targets in municipal plans and policies are needed. Effective monitoring can provide critical information to track temporal trends in NI benefit provision, uncover spatial patterns, and understand how multiple variables interact across scales. Monitoring can be strengthened through longer-term field monitoring and the use of automated monitoring technologies and remote sensing. Investing in platforms that bring together data about water-related benefits and co-benefits is also needed to streamline access to data and build the evidence base for NI collaboratively.

PERFORMANCE AND ASSESSMENT

Working at regional and watershed scales ("Scale matters"):

Strengthening regional- and/or watershed-scale approaches to NI implementation is an important strategy to scale NI and support healthy, resilient watersheds. There are opportunities to accrue benefits and offset negative impacts when a broader landscape approach is taken at the outset. For example, work presented by the Collaborative Leadership Initiative at the forum brought together municipalities and Indigenous communities to identify and implement several NI priorities at a regional scale. Rather than a patchwork of NI projects, there are opportunities to work together across jurisdictions if equipped with the right policy and governance drivers, as well as tools for collaboration and shared decision making (e.g., models, metrics). Watershed data—for example, flow and/or water quality—can also inform building and effectively monitoring more resilient and interconnected infrastructure systems.

Embed within practice ("Set standards and targets"):

A key challenge for building a better business case for NI across the Prairies relates to setting targets for performance and ensuring adequate data to track performance in relation to those targets. For example, for projects interested in biodiversity co-benefits, there are often inadequate performance data and targets to inform assessments. In benefit categories with more straightforward performance metrics, like non-point source water quality, the paucity of monitoring data can be a significant challenge. Setting realistic targets can help direct and prioritize efforts, while the ability to show progress over time can lead to more deliberate actions and could help formally guide design and evaluation for different NI types.

Additionally, many stakeholders expressed a need for more guidance documents to inform local decisions about NI and to formally guide NI design and evaluation across the identified benefit categories (e.g., water treatment, flood protection). For example, Simoes et al. identified that even just small shifts in design philosophy for NI, like naturalized stormwater basins, could prevent the omission of co-benefits from design and optimization. The creation of standards is another important avenue to mainstream NI within practice and to ensure that minimum levels of performance are achieved. Moudrak and Feltmate list several guidelines and standards applicable to NI, such as bioretention systems, but this type of information is not available for all NI types or covers all types of threats. For example, NI that protects against flooding, like water retention, may be designed to withstand an event with exceedance probability in excess of 100 years, but such recommendations to provide resilience in the face of drought are not as well defined.

FUNDING AND VALUATION

Strengthening the use of economic valuation of NI ("Economics is king"):

Economics is a powerful driver of decision making. There is a need to assess the financial value of the benefits of NI and natural assets to better engage decision-makers, particularly municipalities. Making the economic benefits of investing in NI more visible on balance sheets and in regulatory and funding decisions is a key avenue for moving forward; however, there is a need for agreed-upon tools and methodologies, and the development of clearer guidance and support for NI proponents to build the economic case. Conducting applied economic valuations for potential NI projects on the Prairies is a practical way forward, leveraging tools like IISD's Sustainable Asset Valuation (SAVi) approach, Sustainable Technologies Evaluation Program's Low Impact Development Life Cycle Costing Tool, or the Climate Risk Institute's Risk Return on Investment tool, among others.

Equip funders with tools to understand the return on investment of NI ("Inform funding and evaluation"):

Funding agencies (including levels of government) can better share data and their approaches to measuring performance and prioritizing project funding. However, there is a need for simple tools for funders to evaluate the economic value and total societal benefits

of NI to better direct their investments for most impact. IISD worked with the Manitoba Habitat Heritage Corporation (MHHC) to develop the purpose-built Conservation Trust Outcome Assessment Tools, which enables MHHC to better prioritize between projects and to provide ecological goods and services accounting. In this instance, no existing off-the-shelf tool was available to MHHC to provide this service using data tailored specifically to the Prairies. Future dialogue among public and private funders of NI could help accelerate investment, informed by better accounting of the return on investment of NI either financially or in terms of ecological goods and services.

IMPLEMENTATION AND ENGAGEMENT

Build capacity by investing in people and involving local networks ("Support people and networks")

Participants of the forum clearly flagged the need to strengthen capacity across the Prairies for planning, implementing, and evaluating NI. This would include equipping key professional groups (e.g., planners, asset managers, engineers, landscape architects) with training, tools, and resources that would support the execution of NI implementation. Working to include people and community-based organizations (e.g., watershed groups, municipal champions, advocacy groups, citizen science) supports contextually informed decision making and builds a foundation of local support for NI.

Bridge worldviews and address equity ("Two-Eyed Seeing")

Economic value alone does not shape the business case for NI. Many disciplines and ways of knowing—for example, Indigenous and Local Knowledge, science, technology, engineering and mathematics, economics, and social sciences—can inform understanding of the "value" or "values" of NI, and to develop solutions that match local needs. In alignment with Canada's National Adaptation Strategy, the implementation of NI should "Respect jurisdictions and uphold Indigenous rights" and "Advance equity and environmental justice." Through this lens, there is much to learn from the Two-Eyed Seeing approach, which integrates the strengths of Indigenous ways of knowing in one eye and the strengths of mainstream ways of knowing with the other (Prairie Climate Centre, 2021).

To close the forum, IISD committed to supporting shared efforts to build a better business case for NI through the multi-year Natural Infrastructure for Water Solutions initiative.

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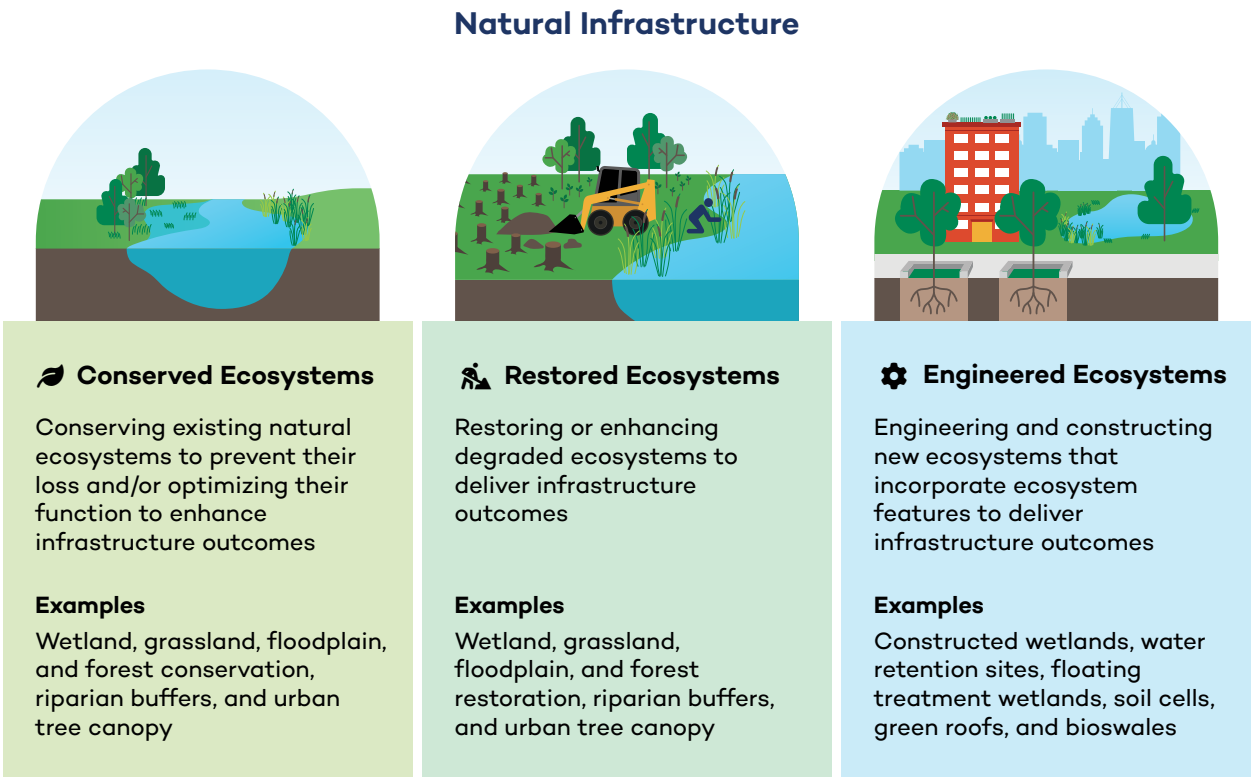
1.0 Natural Infrastructure for Water Solutions

Natural Infrastructure for Water Solutions (NIWS) is a 5-year initiative led by the International Institute for Sustainable Development (IISD) to scale up natural infrastructure (NI) on Canada's Prairies to support cleaner water and more resilient communities. Alongside stakeholders and partners from many sectors, the NIWS initiative is:

- Making the business case for NI by demonstrating its potential impact and cost-effectiveness
- Encouraging local municipalities to adopt more NI projects for water solutions
- Enabling access to funding for those who want to implement NI
- Informing policies to support NI and water management at local, provincial, and federal levels

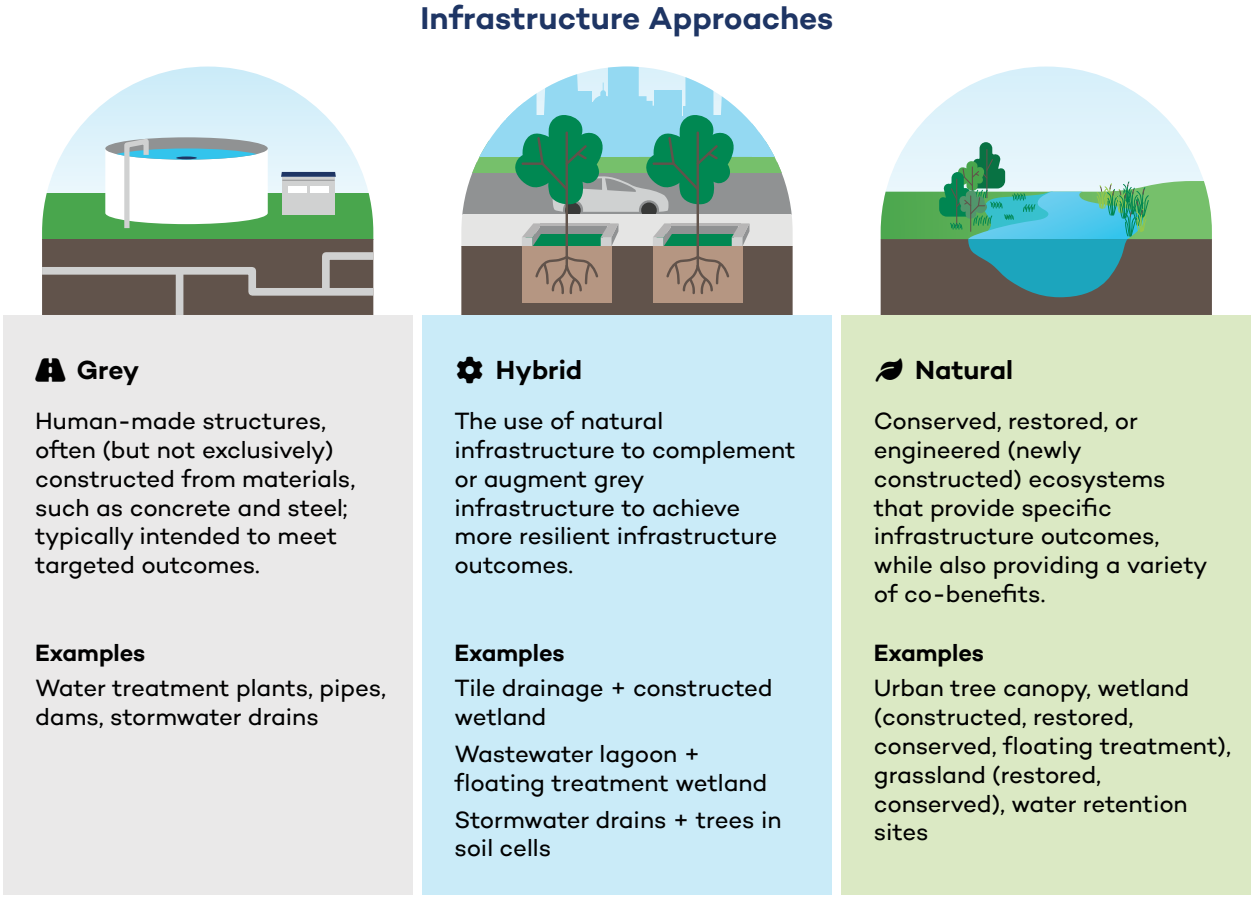
The Canadian Council of Ministers of the Environment (2021, p. iv) states that NI "uses preserved, restored, or enhanced ecosystem features and materials (e.g., water, native species of vegetation, and sand and stone) to meet targeted infrastructure outcomes, while providing a range of co-benefits to the environment, the economy, community health and well-being."

Figure 1. Classification and examples of natural infrastructure: Engineered, restored, and conserved



Working alongside grey and hybrid infrastructure, NI can therefore be used to meet critical infrastructure needs while also providing many other social and environmental benefits. NI can be classified in three ways; conserved, restored, and engineered ecosystems, with natural wetlands, replanted riparian areas, and green roofs as examples of each of these NI classifications, respectively (Figure 1). Across the Canadian Prairies, NI can help meet the growing water-related infrastructure gap in several areas, including stormwater management, wastewater treatment, flood and drought mitigation, and water supply, among others. For the purposes of the NIWS initiative, it is important to define NI in relation to grey and hybrid infrastructure. Taken together, these three general approaches to infrastructure, as presented in Figure 2, can contribute to meeting water-related infrastructure needs across the Canadian Prairies.

Figure 2. Infrastructure approaches: Grey, hybrid, and natural



More information about the NIWS initiative can be found on IISD's (2022) website.

2.0 Forum on Natural Infrastructure Performance and Metrics (Day 1)

NI is essential for water management across the Canadian Prairies and supports the resilience of communities and ecosystems. There is growing recognition of the importance of NI for meeting Canada's water-related infrastructure needs, but there is still a gap in practical methods and metrics to assess and track the performance of NI projects across scales and over time. Funders need metrics to justify investments, governments need metrics to track and evaluate policies and programs, scientists need metrics to support research, and users need metrics to meet water-related needs. Put simply, without clear metrics to measure their performance, NI projects may fail to reach the necessary scale of implementation.

The 2022 IISD Forum on Natural Infrastructure Performance and Metrics was designed to advance the practice of championing and evaluating NI projects for water management. The 2-day forum connected key groups that champion, manage, fund, and create policies for NI across the Prairies—including policy-makers, funders, local governments, watershed groups, scientists, environmental non-governmental organizations, and First Nations. A list of forum attendees and their affiliations is provided in Appendix A.

Darren Swanson and Josée Méthot open the Forum on Natural Infrastructure Performance and Metrics. (Photo: Mike Sudoma/IISD)

Broadly, Day 1 of the forum was divided into the following sessions:

- The need for NI across the Prairies
- NI performance and metrics
- Building the business case for NI
- Prioritizing the uses, needs, and opportunities for NI metrics

The forum was hosted by **Darren Swanson, Director of Novel Futures Corporation and IISD Associate** and **Josée Méthot, Senior Policy Specialist with IISD**. Josée opened the forum by introducing the NIWS initiative and acknowledging the forum's presence on Treaty 1 territory.

2.1 Session 1: The need for natural infrastructure across the Prairies

Main Points

- NI provides critical benefits and co-benefits, but municipal governments lack mechanisms and standards to understand and implement it. Politicians and decision-makers tend to plan around short-term election cycles, but we need long-term solutions.
- Climate change, especially drought, will be a key driver of investment or policy change supporting NI, thanks to the municipal and rural focus on water quality and quantity.
- Strong metrics and education can support the business case, helping the public and municipal decision-makers understand that NI is a viable alternative for (and complement to) grey infrastructure, making it more of a go-to and incorporated into policy. Perhaps municipalities are already collecting relevant data that can be used for metrics without additional funding. If metrics don't inform decision making, it is not useful data.
- Funding for NI implementation and metrics needs a significant boost if we are ever going to see uptake at a watershed scale, and to better understand the benefits of widespread adaptation.

2.1.1 Natural Infrastructure for Water Solutions: The Imperative Armchair Discussion

The Imperative Armchair Discussion highlighted the drivers accelerating the need for NI and the challenges around the metrics needed to build a better business case. The armchair discussion was moderated by **Dimple Roy, Director of Water Policy at IISD**, who asked the following questions:

Dimple Roy, Director of Water Policy at IISD (Photo: Mike Sudoma/IISD)

What are the drivers that accelerate the need for NI?

Roy Brooke, Executive Director of the Natural Assets Initiative, explained that engineered solutions alone will not provide the infrastructure services that society needs; NI is not "nice-to-do" but is fundamental. NI provides an alternative, meeting basic needs while providing critical co-benefits, ranging from flood-risk reduction to the biodiversity that supports food production. NI isn't just the construction of new ecosystems but also the conservation of intact ecosystems, which needs to be prioritized. It is more cost-effective to preserve rather than trying to build to regain lost ecosystem services. There

is a lack of drivers for NI at local levels, as municipal governments lack mechanisms and standards to understand and implement NI.

Duane Nichol, Chief Administrative Officer with the City of Selkirk, described that local governments are designed to work within artificial, political boundaries and that society tries to apply NI the same way, although nature isn't constrained in the same way. Politicians and decision-makers often plan in the short term, whereas the City of Selkirk is working around a long-term strategy, trying to implement approaches to manage urban tree canopy and stormwater to preserve the groundwater aquifer and drinking water source for the future.

Duane Nichol, Chief Administrative Officer with the City of Selkirk (Photo: Mike Sudoma/IISD)

Lara Ellis, past Senior VP of Policy and Partners with ALUS Canada, highlighted the impacts of climate change as a major driver for NI, particularly in response to the recent extreme weather events in British Columbia and the "yo-yo" phenomenon of Quebec's wet spring followed by summer drought. The Modeste Natural Infrastructure Project (ALUS, 2022), an agricultural NI project in northwestern Alberta, identified targets for the amount and type of NI required in specified locations required to meet water-related goals. Lara also discussed the importance of the NIWS Initiative to support the coordination of efforts around the monitoring and evaluation of NI. Municipalities are interested in water quality and quantity, particularly when there is too much or too little water; drought will be a key driver of investment or policy change supporting NI in the prairie context.

What type of metrics[1] will build a stronger business case for NI and what are the challenges?

Duane Nichol discussed the three audiences needed to scale up NI—municipal council, public, and future generations. Municipal council needs metrics to support that NI is a viable alternative to grey infrastructure. There is the political will to increase NI, but they need the tools that support the business case to make NI the default and incorporate it into policy. The public wants common-sense decision making and will support NI if it is easily understood as a good, sensible option. Duane also stated that posterity considers that the decisions we make today will, without a doubt, benefit future staff and residents.

[1] Myriad indicators, metrics, and frameworks can be applied to identify and evaluate specific benefits and co-benefits of natural infrastructure, although there is currently no clear consensus regarding best practice (Shiao et al., 2020). A thoughtful selection of relevant metrics for different NI types, evaluating benefits toward solving different water management issues, and any co-benefits, is therefore required.

Lara Ellis discussed the importance of robust metrics in rural agricultural landscapes. One example is the need for an integrated and collaborative approach to measure nutrient reduction in water quality and retention for water quantity. Rural landowners need better Internet access to make use of tools and knowledge products. There needs to be trusting relationships between landowners and delivery agents to ensure that landowner data is collected accurately and stored securely. Lara also added that the development of robust metrics systems will be costly and there is a lack of government investment—how will we pay for this?

Roy Brooke stated that we can identify the wide range of services that NI provides with a good degree of accuracy and the potential cost to achieve the same level of services with grey infrastructure. However, many of the existing projects are small pilot projects and do not consider the role or necessary scale of NI required within the larger picture. The federal funding available through the $200 million[2] Natural Infrastructure Fund (over 3 years) is good, but we need larger funding to support more NI projects and to understand the benefits on a large scale. Roy mentioned Grand Forks, British Columbia, which has estimated a cost of approximately $50 million to protect vulnerable residential and downtown areas from flooding by floodplain re-establishment and wetland creation; this project alone helps to contextualize the size of the Natural Infrastructure Fund. Roy also acknowledged that Indigenous Peoples[3] must be an integral part of the entire initiative around NI. The language used around NI may not resonate the same way with Indigenous communities. On our journey toward Truth and Reconciliation, we need to learn, consider, and support Indigenous views, knowledge, and perspectives.

Roy Brooke, Executive Director of the Natural Assets Initiative (Photo: Mike Sudoma/IISD)

2.1.2 Natural Infrastructure: A retrospective presentation

Richard Grosshans, Lead – Bioeconomy at IISD, provided an overview of NI, historically and as understood today, across the Canadian Prairies. There are many interpretations of the meaning of NI, but Richard summarized NI as "utilizing the power of nature" to achieve infrastructure outcomes." The growing issues in the Lake Winnipeg Basin were eye-opening in recognizing that Lake Winnipeg is on the receiving end of all the isolated basins upstream and

[2] All figures in CAD.

[3] Indigenous Peoples is a collective term to describe three distinct groups: First Nations, Métis, and Inuit communities.

that we must consider the impact of our actions on a watershed scale. IISD has long been involved in assessing the performance and financial value of the services provided by NI, including the following projects:

Richard Grosshans, Lead – Bioeconomy at IISD (Photo: Mike Sudoma/IISD)

- **Pelly's Lake** is a natural wetland actively managed for flood and drought control as well as additional co-benefits (improved habitat and biodiversity, groundwater recharge, nutrient and sediment sequestration, carbon offsets and various economic uses of the biomass, i.e., plant material). A Sustainable Asset Valuation (SAVi) assessment determined that the cumulative value of the services provided by Pelly's Lake is approximately $60 million between 2019 and 2050; the cost to build grey infrastructure to provide similar services was estimated at $25 million (Bassi et al., 2019). The operation and maintenance costs for the same time frame were $0.18 million for Pelly's Lake and $12 million for grey infrastructure.
- **Floating treatment wetlands** are artificial platforms that allow aquatic emergent plants to grow in water that is typically too deep. The unique ecosystem that develops creates the potential to capture nutrients and transform common pollutants that would otherwise contribute to poor water quality in streams, rivers, and lakes. IISD continues to examine their performance in conventional stormwater ponds and wastewater treatment lagoons in Manitoba, as well as at the IISD-Experimental Lakes Area (IISD-ELA) in northwestern Ontario.
- **Retention ponds**, including sites at De Salaberry and Ste. Geneviève, where IISD is collecting data and modelling performance around water retention and water quality treatment performance. Alternative site management and design modifications to improve retention time at the site are also being examined. One of the intended outcomes is to create simple and effective methods for other professionals to optimize the design of future retention ponds.

2.1.3 Discussion

Forum participants asked presenters the following questions:

What is the one thing you would do immediately around metrics?

A wide variety of projects and metrics are required to effectively meet infrastructure needs. In some instances, we may not need additional metrics or funding but rather need to use the metrics that we already collect more strategically. Metrics needs to inform decision making; otherwise, it is just data and not valuable.

To have a positive effect on the broader landscape, and quickly, we have to "double down on what works." There are already many approaches that we know work and do not need more metrics to justify. We should build on these existing efforts. There are particular municipalities that are very progressive in natural asset management, but their effort will stall if it doesn't move beyond jurisdictional boundaries. Municipalities, watershed districts, and provincial/federal governments need to **"work together at scales that matter."** This large-scale effort can be supported if federal funding was expanded to include private land and with the development of federal legislation.

(Photo: Mike Sudoma/IISD)

From a First Nations perspective, how do we involve youth? We must work with them to understand policy today for a better tomorrow.

Engagement and education are key because people care when they understand or are impacted. We need to fine-tune our communication, using messaging that is relevant to the audience. For example, residents will pay more attention to onsite infographics about an NI project when the road closures and construction are impacting their daily commute. Youth may be more interested in learning about NI benefits like biodiversity, water quality, and recreational enhancement rather than solely financial advantages. The positive impact of youth engagement was evident in Gibsons, British Columbia, where the municipality increased water rates with little opposition. There was already an understanding that the groundwater aquifer is central to their community.

A reminder that we also need to empower youth around the future of their communities in a changing climate, rather than focus on "doom and gloom." Too much bad news is bleak; rather, we want youth to feel empowered to act.

2.2 Session 2: Natural infrastructure performance and metrics

Main Points

- The performance and metrics of some NI approaches are already well understood, with standards and ongoing implementation. In these examples, the business case has already been made!
- The decision is not exclusively grey or NI but often a hybridized approach designed to be resilient to climate change. However, it is challenging to effectively compare the different approaches.
- Setting specific performance targets will help scale up NI.
- NI has positive benefits, but it is important to understand the trade-offs or externalities.
- Funders are investing in NI, and they expect either a financial return on investment or a return through the provided ecological goods and services or benefits. The development of a widely accepted metrics system would bring more investors and support better policy.
- Consider cultural or local indicators that are important to project partners, like the value of investment in the local economy or better access to traditional medicines.
- Existing tools, including SAVi (IISD, 2023), Nature-Based Solutions (NBS) Benefits Explorer (CEO Water Mandate et al., n.d.), the Conservation Trust Outcome Assessment Tools (CT OATs), Low Impact Development Life Cycle Costing Tool (2019) and Risk and Return on Investment Tool (Climate Risk Institute, 2019), are already available to support the business case for NI. We need to continue to build capacity to support the expansion of NI.

2.2.1 Natural Infrastructure Performance and Metrics: Rapid panel insights

The rapid panel session provided insight into the current state of play for NI from groups such as developers, funders, NI advocates; it also included Indigenous perspectives. The panel addressed the question, "How is NI performing, and what types of metrics are used? What are the needs and opportunities?"

Gregg Brill, Senior Researcher at the Pacific Institute, acknowledged that many organizations, in both the public and private sectors, are interested in NI; it is slowly being

(Photo: Mike Sudoma/IISD)

normalized. It is not a choice between grey or green, but often hybridized approaches. NI often performs as well as grey infrastructure, and investors are looking for credible, standardized, and robust indicators. However, the comparison of grey to NI is not "apples to apples," so we need to be able to compare the two approaches effectively and efficiently. To support this effort, we need data that is context specific and geographically appropriate. Some regions completely lack important types of data (groundwater aquifer characteristics in parts of Africa, for example). Metrics that consider different cultural views are critical, although that is not always easily accessible, and it is challenging to appropriately account for these benefits.

Gregg Brill, Senior Researcher at the Pacific Institute (Photo: Mike Sudoma/IISD)

Gregg explained three challenges in scaling up NI, which include investment, climate change, and trade-offs. Although there is increasing investment for NI in North America and Europe, grey infrastructure is still the go-to, particularly in North America, and even more so in the Global South, due to uncertainty around design, implementation, monitoring, and evaluation. Monitoring and evaluation are critical but also costly. Policy to support NI would be helpful, but it is difficult to allocate budgets from multiple, siloed departments into collaborative projects. Worldwide, NI needs to be designed to be resilient to the anticipated impacts of climate change. NI is often seen as exclusively positive, but it can come with trade-offs, too. For example, a naturalized treatment wetland may require a larger area of land compared to a conventional wastewater treatment facility.

Despite these challenges, we see that interest in and implementation of NI are growing globally, along with the availability of funding. The motivation for NI is moving beyond more traditional applications to meet more broad social objectives, with naturalized wastewater treatment sites now also providing areas for public recreation. Various tools, like the NBS Benefits Explorer[4] (CEO Water Mandate et al., n.d.) or SAVi (IISD, 2023), are already available to support the business case for NI. We need to continue to build capacity to support the expansion of NI.

Samantha German, Grants Associate at the Manitoba Habitat Heritage Corporation (MHHC), discussed the metrics required from a funder's perspective. MHHC administrates Manitoba's provincial endowment funds (the Conservation, GRowing Outcomes in Watersheds [GROW], and Wetlands GROW Trusts). MHHC also provides additional programming for

[4] The NBS Benefits Explorer, developed by the Pacific Institute, provides a benefit valuation of the stacked benefits of different restoration or NI actions.

habitat conservation, primarily in the agricultural regions of Manitoba. Samantha explained that the funding provided to recipients is an investment, and as such, MHHC expects a return on the investment through the provided ecological services or benefits. A widely accepted metrics system would allow the better sharing of the work and benefits of NI, bringing in more investors and supporting better policy. Funders also want to understand the risks or trade-offs with NI, so they know that the projects they support will not create issues that will cost more money in the future.

(Photo: Mike Sudoma/IISD)

To better support funding initiatives, investors need clearly defined metrics that can be applied across various funding streams, enabling impact assessments from different NI projects. While tools and accounting systems to evaluate NI exist, these tend to be specific to particular types of NI and regions, and they also lack robust standards for which specific ecological goods services are provided by NI, further complicating sound comparisons. The carbon credit economy is an example where the standards are voluntary and primarily based on assumptions, with little understanding of the potential ramifications of the risk of error. Acquiring, collecting, and managing additional data will support the development and application of a more robust metrics system; however, this comes with an increased cost for data management. Some organizations and landowners are also reluctant to share data, so we need mechanisms to protect participants' data and time to build trusting relationships.

MHHC and IISD collaborated to develop the Conservation Trust Outcome Assessment Tools (CT OATs), which use data shared by fund grantees as part of the funding requirements. Alleviating some of the issues of existing tools and accounting systems noted previously, CT OATs provides ecological goods and services assessments to meet the specific reporting requirements of the Government of Manitoba and was made specifically to assess the projects MMHC actually funds and the geography that they are developed in.

Richard Farthing-Nicol, Project Manager with the Centre for Indigenous Environmental Resources (CIER), described four NI projects that they have implemented with First Nations and Manitoba Municipalities, as part of the Collaborative Leadership Initiative.[5] Community leaders worked together to protect their water resources in four different projects, which included:

[5] The Collaborative Leadership Initiative is "a facilitated process that provides resources and expertise to support Indigenous and municipal elected leaders as they find solutions to shared water challenges" (CIER, 2022).

- Shoreline stabilization with rock barriers and native trees in Sagkeeng First Nation
- Biomass harvesting at Grant's Lake in the Rural Municipality of Rosser (see Section 2.3.2)
- Cultivation and removal of duckweed in the Village of Dunnottar's wastewater lagoon
- Tree planting in Sandy Bay Ojibway First Nation

While carrying out the above projects, CIER discovered that it is critical to fine-tune metrics specific to the issues facing a community. For example, communities that live far from Lake Winnipeg are less concerned with eutrophication, so nutrient concentrations are not as strong a priority compared to species diversity along a riparian area. Similarly, funders and investors may be interested in specific indicators that should be prioritized during project design and evaluation.

Biophysical measurements are certainly of interest, but so are economic, social, and cultural values. For example, the project in Sagkeeng exclusively hired local contractors and labour for the shoreline stabilization project. How many work opportunities did that generate? What was the value for rural economic development? There are similar questions around the tree planting project in Sandy Bay. Does the project create space for cultural and ceremonial engagement? What is the value of the new area where traditional medicines will be harvested? These factors are often considered in project design but are difficult to quantify.

Leta van Duin, Executive Director of Alberta Low Impact Development Partnership, shared valuable insight around her experience working with stormwater management in urban settings, addressing the issue of increases in impervious surfaces. Leta understands "that the whole landscape contributes to the problem, so we need the whole landscape to contribute to the solution." Some community developers and consultants already have standards and are regularly implementing beneficial practices (e.g., deeper topsoil in urban development for improved water-retention capacity); for well understood initiatives like this, the business case has already been made! Low-impact development (LID) in urban communities is a clear example of leadership related to NI implementation.

Leta van Duin, Executive Director of Alberta Low Impact Development Partnership (Photo: Mike Sudoma/IISD)

To grow NI quickly, a "green-first" approach needs to be incorporated when upgrading or designing new infrastructure. The builder must also consider options that increase efficiency or water conservation. For example, the City of Minneapolis (2021) has a **Municipal Owned and Operated Sustainable Building Policy**, which requires the incorporation of strategies to retain

stormwater on site, planted with native and pollinator species, and use 100% of available roof area as sustainable roofs, including green roofs or solar panels.

The Alberta Wetland Policy (Government of Alberta, 2013) requires compensation for the loss of wetlands; however, compensation is only for the restoration, enhancement, or construction of another wetland. Wetland loss is inevitable in urban development. LID, like bioretention, should be eligible for compensation funding, as they are analogs of wetlands and contribute to restoring landscape functionality.

When measuring the performance of NI or LID, it is important to consider the influence of the surrounding landscape (e.g., a wetland in a natural floodplain versus a wetland in a developed urban community). We need to set performance targets that are required in specific areas (e.g., mm of precipitation for retention) to really increase uptake, not just measuring and modelling benefits. To understand the performance of NI, we really need to consider position on the landscape.

2.2.2 Breakout Summary From Session 2

A breakout session tasked forum participants with identifying current challenges and opportunities for tracking NI performance using metrics. Groups were separated based on five clusters of NI types and were asked to provide answers to the breakout session questions based on specified benefit categories. The NI clusters included:

- Wetlands and floating treatment wetlands
- Water retention and flood bypass
- Ecosystem conservation and restoration
- Urban natural infrastructure
- General (in which case all NI types were considered) for virtual participants

(Photo: Mike Sudoma/IISD)

Challenges

Metrics development and performance monitoring are costly, and there is also a lack of funding to understand the long-term performance of NI. Since NI incorporates vegetation and natural processes that take time to establish, performance will likely improve over time, but this is not captured in the common 1 or 2 years of monitoring after project establishment. There is a benefit in incorporating long-term monitoring from the beginning of a project, as opposed to monitoring

as an afterthought. Participants considered the diminishing return on the money invested in monitoring and asked, "What is good enough?"

Participants commented that there are few consistent metrics that could be widely adopted by different departments or organizations to efficiently monitor and compare the performance of various NI systems. The broad suite of metrics that are currently used aren't easily translated or repeatable between different authorities. Many groups lack financial or staff resources to implement metrics programs, using the data to make decisions for the municipality or watershed district, making the connection that "every land-use decision is a water decision."

(Photo: Mike Sudoma/IISD)

There are number of knowledge and data gaps that limit our understanding of performance. Some are very specific to particular types of NI. For example, how does cold weather impact the performance of wetlands? How does site management (harvesting vs. leaving cattail) influence phosphorus removal? More generally, we still need to understand how NI performs in comparison to grey infrastructure for specific applications, as well as the impact of surrounding land use (e.g., grassland vs. annual cropland; high-density urban vs. low-density rural). Availability of data varies, with larger urban centres often having the financial and staff resources to support analysis. Lastly, there are methodologies to measure qualitative performance indicators around water quality or quantity, but it is difficult to measure other critical—but subjective—benefits like recreation, aesthetics, and culture.

When designing NI projects and thinking about metrics, we need to consider the future so that infrastructure is resilient to climate change while meeting the land-use changes of the evolving community (e.g., population growth or contraction). If more design standards are published, stakeholders will have to agree on risk tolerance. For example, is a 1-in-100-year flood good enough? 1-in-300-year? Do we have an agreed-upon understanding of how the magnitude of these events will change resulting from climate change?

(Photo: Mike Sudoma/IISD)

Opportunities

Participants suggested that the implementation of a consistent approach to metrics and the ability to share data among organizations are opportunities to scale up NI. The establishment of a defined NI data co-ordinator and data access hub would increase accessibility, and financial support could potentially be obtained through private investment. As weather disasters become more common, there is greater need for public data and information to drive decision making. The insurance industry is one example where overland flooding insurance is harder to obtain due to the increased frequency of flood damage. Making flood maps/data publicly available to realtors, developers, and so on could help buyers make decisions based on risk awareness. In turn, insurers could provide discounted rates for people who buy houses outside of areas with higher flood risk, hopefully discouraging people from living or building new housing on flood plains.

The lack of funding for monitoring (both short- and long-term) was identified as a challenge; however, there are many new ways to address the challenge. New technologies (real-time monitoring, remote sensing, LiDAR) can improve and simplify monitoring and will become more affordable as they become more mainstream. Citizen science is another opportunity to involve the public to increase understanding while collecting additional data that is needed.

(Photo: Mike Sudoma/IISD)

Standards do exist for NI projects, but after a lot of work during development, some argue they "just sit on the shelf as there is no training and support to use and apply in the real world." Standards could be more valuable if there was more awareness and removal of paywalls (Canadian Standards Association, for example), and they were connected to the industries they are developed for (and co-created with the intended users). The standards could also include a common methodology for monitoring metrics and performance.

Just as citizen science increases public support for NI, we need to make it "cool" to have NI in urban settings to encourage widespread adoption, like a naturalized stormwater pond in your neighbourhood or a rain garden in your front yard. Participants suggested neighbourhood demo sites to showcase that NI can be functional and beautiful or even included in popular home improvement television shows.

These identified gaps, challenges, and opportunities were later used to complete the afternoon breakout activity summarized in Section 2.4.2.

2.3 Session 3: Building the business case for natural infrastructure

Main Points

- IISD is collaborating on several NI tools, including CT OATs, Prioritize Target and Measure Application (PTMApp), SAVi, and PhosFinder to understand various aspects of their use, performance representations, optimal locations for NI construction, comparisons to grey infrastructure, and socio-economic barriers or incentives. The creation of simplistic and effective methods for other professionals to optimize the design of future NI is a priority.
- We still do not comprehensively understand the impact of actions on the landscape, like the long-term consequences of wetland drainage, for which wetland class or size may influence the outcomes differently, or how the addition of different plant species may impact carbon sequestration in wetland restoration. We lack a complete wetland inventory and mapping across the Prairies and an understanding of the financial benefits of wetland conservation as opposed to drainage from the farmer's perspective.
- Current funding prioritizes restoration instead of the conservation of intact wetlands. Development is inevitable, but we should prevent the destruction of key areas, like source watershed areas.
- Municipalities are often motivated by economics, so we need to connect the financial value of the benefits of NI and natural assets to resonate with municipal decision-makers and their communities' specific priorities.
- "No water is excess": We need to take advantage of stormwater by collecting, treating, and using it with NI while understanding NI will have performance limits under the characteristics of urban stormwater (high volume, high concentration of nutrients and contaminants).
- We need thoughtful design from the start to address social vulnerability and to consider the future impacts of climate change in design, ensuring resilient communities and landscapes. The inclusion of NI into urban development automatically creates public greenspace, which is critical to communities. We may need to look to unique data sources (like property values) to understand these influences.
- The application of "big data" will help streamline metrics, helping to quantify the performance of NI and ultimately increasing investor interest.

2.3.1 Tools, Methods, and Models

Although not the focus of the forum, tools, methods, and models are crucial for building a better business case for NI. IISD staff demonstrated some applications of tools from recent projects and invited forum participants to share their own via a virtual Padlet wall space.

Joey Simoes, Hydrologist at IISD, provided an overview of tools and models used by IISD, including CT OATs (see Section 2.2.1), a tool that is specific to the context and climate of Manitoba. PTMApp assesses non-point source nutrient loading, NI feasibility, and nutrient reductions under various hydrologic events to identify locations for development with the greatest return on investment. IISD is also currently monitoring and modelling the performance of two retention ponds in Southern Manitoba at De Salaberry and Ste. Geneviève (see Section 2.1.2). One of the intended outcomes of this work is to create simplistic and effective methods for other professionals to optimize the design of future retention ponds, strengthening this effort with additional data from similar sites monitored by the Lake Winnipeg Foundation and Agriculture and Agri-Food Canada (Simoes et al., 2022).

Joey Simoes, Hydrologist at IISD (Photo: Mike Sudoma/IISD)

Marina Puzyreva, Policy Advisor at IISD (Photo: Mike Sudoma/IISD)

Marina Puzyreva, Policy Advisor at IISD, discussed some of the economic valuation tools that can be used for NI, including cost-benefit analysis (CBA) and subsequent challenges. The funders' requirements tend to guide the level of rigour required for the CBA. Marina shared two examples of CBA that IISD completed. The first example is Pelly's Lake, using the SAVi Tool, which showed that the value of benefits (primary and co-benefits) far exceeded the cost, and that the construction and operation and maintenance of a comparable grey infrastructure are greater than the cost of NI (see Section 2.1.2). The second example was for the valuation of water-retention projects in Southern Manitoba (Puzyreva et al., 2022), which included a producer survey to understand the socio-economic barriers and incentives for agricultural beneficial management practices and the use of a simplified version of the PTMApp methodology to assess water quality benefits.

2.3.2 Rapid Presentations on the Use and Development of Natural Infrastructure Metrics

Pascal Badiou, Research Scientist at Ducks Unlimited Canada (Photo: Mike Sudoma/IISD)

Pascal Badiou, Research Scientist at Ducks Unlimited Canada, explained that Ducks Unlimited Canada shifted from purely waterfowl conservation to considering the broad benefits of wetlands in the Canadian Prairies. The organization began to gather empirical data, which supported the important role of wetlands in regulating water quantity and limiting nutrient export. This understanding contributed to substantial changes in Manitoba's wetland policy and supported the expansion of wetland restoration programs and funding opportunities. Although groundbreaking, this past research only scratched the surface, as our understanding is based on the presence or absence of wetlands. Learning about the different characteristics of wetlands and subsequent benefits will create more diversity with improved outcomes.

A major challenge in developing performance standards is that we still do not fully understand the role of wetland drainage, and it likely has more impact than we think. We lack a complete wetland inventory and mapping across the Prairies that would allow better monitoring. We do not understand how benefits are influenced by differences in wetland class or size and approaches to construction/design.

As wetland drainage continues, we need to show producers the financial advantage of wetland conservation or restoration as opposed to farming on that marginal land. This can also help determine accurate incentive/compensation rates. A lot of existing funding prioritizes restoration instead of the conservation of intact wetlands; conservation is much more beneficial and cost-effective than restoration. We need to find the proper balance of funding for these actions, continuing to support producers while discouraging ongoing loss.

There are some exciting opportunities to learn more about the performance of NI, including how the addition of certain plant species during wetland restoration can enhance carbon sequestration. We can learn about the management of existing Ducks Unlimited Canada-constructed wetlands to enhance their provision of benefits. There are opportunities to optimize the function of existing infrastructure with the addition of NI. For example, water reservoirs are filling and emptying more quickly thanks to increased frequency of heavy precipitation and drought. How can wetland restoration or conservation enhance the function of the reservoirs?

Twyla Kowalczyk, Climate Resilience Specialist with Associated Engineering (Photo: Mike Sudoma/IISD)

Twyla Kowalczyk, Climate Resilience Specialist with Associated Engineering, discussed the importance of natural asset inventories for municipalities, recognizing that they need to include a broad range of assets, from natural to enhanced to engineered. Each municipality will prioritize different assets based on its needs and location. We need to fine-tune our communication to what resonates with each municipality. Municipalities are motivated by economics, so we need to connect the financial value of the benefits of NI to resonate with municipal staff who control budgets. For example, for a community that uses a river as its primary water source, what are the financial benefits of incorporating NI into the source watershed (which may be outside of their jurisdictional boundary)? There are advantages to assigning values to these environmentally significant areas, helping to understand areas, like source watersheds, that are most important to protect. Development will continue, but this could direct activity to prevent the destruction of key areas.

We need thoughtful design from the start to address social vulnerability—reducing the impact of heat islands takes more than installing benches under trees. We also need to consider the future impacts of climate change in design, ensuring resilient communities and landscapes. There are existing issues around equity and access to environmental amenities. Take vulnerability to extreme heat, for example. People with higher incomes (who often live in suburban areas with more trees and air-conditioned homes) still have more access to "natural areas," whereas lower-income families (who often live in urban areas more vulnerable to heat effects and lack air conditioning) have less access. There is little existing data on the intersection of NI and public access, and we may have to look at unique sources of data, like property values, to assess these connections.

Anton Skorobogatov, Research and Development Lead with MAGNA Engineering Services (Photo: Mike Sudoma/IISD)

Anton Skorobogatov, Research and Development Lead with MAGNA Engineering Services, discussed how, in urban stormwater management, development increases impervious surfaces, creating

"too much [water], too fast." Urban stormwater management options to mitigate these issues can be at the source (LID like bioretention, green roofs, rain gardens) or end of pipe (stormwater management ponds). Anton is currently working with the City of Calgary to update its stormwater guidelines, promoting the concept that "no water is excess." We need to take advantage of stormwater by collecting, treating, and using it with NI. We can consider the benefits that NI creates for amenities and placemaking; by incorporating NI into urban developments, we automatically create public greenspace, which is critical to communities.

As we work to scale up NI on the Prairies, we need to understand the limits of NI, which may risk the ecological function under the characteristics of urban stormwater (high volume, high concentration of nutrients and contaminants). An additional gap is that there are currently no tools that help balance priorities in the conservation, restoration, or development of NI.

Hank Venema, CEO and Senior Engineer with Strategic Systems Engineering, discussed the opportunity for big data to support the understanding of NI performance. To effectively scale up NI, it is necessary for investors to have access to high-quality project networks, verified with earth observation through remote sensing. It can also be challenging to attract contractors for small NI projects due to high projects costs and competitive bidding.

Hank Venema, CEO and Senior Engineer with Strategic Systems Engineering (Photo: Mike Sudoma/IISD)

PhosFinder is an example of a free software package developed by Strategic Systems Engineering that uses "GIS information to estimate non-point loading of phosphorus and nitrogen at any point in a watershed using high-resolution Digital Elevation Models derived from LiDAR" (Strategic Systems Engineering, 2022). The mapping of PhosFinder was used for the biomass harvesting project at Grant's Lake with CIER, based on the potential for phosphorus export. The harvested biomass can be used as a heat source or to create biochar. Once completed, they used normalized difference vegetation index imagery to confirm that the harvest actually removed a source of phosphorus from the Lake Winnipeg Basin.

These types of tools can better quantify the positive benefits that beneficial management practices and NI are producing, thereby increasing investor interest.

2.3.3 Discussion

Forum participants asked presenters the following questions:

At retention pond sites, what are the challenges for collecting water quality and quantity data? Can we manage data digitally to improve management and track performance of NI?

The frequency and quality of sampling required for accurate measurements of nutrient loads are a challenge in transient systems like those used for stormwater management. We use Teledyne ISCO autosamplers rather than grab sampling for this reason and are now even piloting the use of ultraviolet–visible spectroscopy to measure nutrient concentration data like phosphorus remotely and in real time.

The Canadian Wetland Inventory, which previously identified and delineated wetlands manually, has now moved to an automated approach. They would like to use this to build a national wetland inventory and track changes over time. Nonetheless it will take time to develop this digital approach.

Do you include social vulnerability in CBA? Should we emphasize vulnerable populations that lack resources to minimize their risk?

Flood protection is one of the benefits considered in the presented CBA, but vulnerable populations are not specifically included. The United Kingdom includes the number of socially deprived households that would be included in an infrastructure project as part of its measure of outcome benefits; similar data in Canada would be useful.

Joanna Eyquem, Managing Director, Climate-Resilient Infrastructure, Intact Centre on Climate Adaptation (Photo: Mike Sudoma/IISD)

When Ducks Unlimited Canada originally built their wetland projects, did they consider benefits beyond waterfowl?

Historically, Ducks Unlimited Canada was focused on creating habitat to support waterfowl. As the organization evolved based on scientific understanding, they shifted away from large staging marshes, as they discovered small wetlands were critical. There is a huge opportunity to explore historical projects on the landscape and how to manage them as NI today.

What has changed since the City of Calgary learned the value of its natural assets[6]? Has it attracted new investments? Who is the City of Calgary speaking to about source water protection?

The natural asset valuation summary piqued the interest of senior asset management staff, growing interest and bringing new participants to the conversation. The 2013 floods, years prior to this valuation, helped initiate the conversation and allowed for a cost-avoidance analysis. The analysis showed that intact riparian zones had very little damage compared to those that were developed with homes or infrastructure. This resulted in a call to action for the protection of riparian areas.

The next focus is the source water protection plan, which is led by the Calgary Metropolitan Region. We must reinforce that "every land-use decision you make is a water management decision." City of Calgary staff have been emphasizing this with municipal decision-makers, encouraging the adoption of NI when making land-use decisions.

2.4 Session 4: Prioritizing the uses, needs, and opportunities for natural infrastructure metrics

Main Points

- Access to data, growing concerns around climate change, and the inequality around those most vulnerable to climate change impacts are the main drivers changing the needs and opportunities for natural infrastructure in the Canadian Prairies.
- We need to create standards around data management, rethink what is truly valuable, and ensure credibility among increasingly easy access to information and the proliferation of misinformation.

Todd Scaletta, Senior Vice-President of Foresight and Research with the Chartered Professional Accountants of Alberta (Photo: Mike Sudoma/IISD)

2.4.1 Future Trends That May Shape the Canadian Prairies

Todd Scaletta, Senior Vice-President of Foresight and Research with the Chartered Professional Accountants of Alberta, gave a brief glimpse into the

[6] A 2021 analysis demonstrated that natural assets provide significant value to the City of Calgary, in the range of $2.5 billion annually (City of Calgary, 2021).

four main drivers of change up to 2030 and beyond. These drivers will shape the future of the Canadian Prairies.

1. **Technology:** Data is the new currency, and data is growing globally and exponentially. We need to consider data quality, integrity, security, and use. Accountants use data in the following ways; descriptive (what happened), diagnostic (why it happened), and predictive (what will happen). Then they can be prescriptive, using this information to make recommendations for the future.
2. **Environmental:** People are worried about how they will be impacted by climate change (72% internationally and 75% of Canadians ages 18–49).
3. **Societal:** The population is aging. Worldwide, people are living longer and having fewer children.
4. **Economic:** Climate change will not impact everyone similarly, with some parts of the population harder hit. The aging population has higher associated costs, including pension and health care.

So what? Todd thought about different critical certainties and uncertainties and came up with the following considerations as we plan for the future.

1. Mastering data: We are data rich but information poor. This can be improved by developing data standards.
2. Reshaping value creation: Reconsider what it means to create value in both financial and non-financial ways.
3. Protecting integrity, trust, and ethics: We need credibility in an age overwhelmed by information and misinformation.

2.4.2 Breakout Summary From Session 4

The second breakout session tasked forum participants with identifying tasks that could address the current challenges and opportunities identified during the morning breakout session. Groups were again separated based on NI groups and the identified tasks were prioritized using effort–impact boards. The output from this exercise was an evaluation of the most effective use of resources to accelerate the adoption of NI across the Prairies. A synthesis of information by IISD produced next steps that could be organized into one of four key areas:

- Data and knowledge
- Performance and assessment
- Funding and valuation
- Implementation and engagement

These next steps are shared in Box 1.

Box 1. Next steps for NI Adoption across the Prairies

DATA AND KNOWLEDGE

Focus on metrics that matter to decision-makers ("Tell the story"):

A better business case for NI will require metrics, data, and communications tailored to the needs of different audiences, packaged in a way that tells a compelling story. Understanding the information needs of key audiences, including funders, policy-makers, local decision-makers, and NI professionals (e.g., engineers, municipal planners, and asset managers) is essential. There can be important trade-offs between the rigour and accuracy of metrics on the one hand and practicality and usability on the other. For example, the metrics that decision-makers or funding program use are often different than those used by researchers. For local communities, there is a growing interest in the risk-reduction benefits of NI, alongside an interest in practical metrics related to implementation (e.g., cost, maintenance, etc.).

Invest in data and shared platforms ("Leverage data"):

There are significant opportunities to collect and share data to inform NI design, implementation, and evaluation. Natural asset inventories need to be developed, and NI targets in municipal plans and policies are needed. Effective monitoring can provide critical information to track temporal trends in NI benefit provision, uncover spatial patterns, and understand how multiple variables interact across scales. Monitoring can be strengthened through longer-term field monitoring and the use of automated monitoring technologies and remote sensing. Investing in platforms that bring together data about water-related benefits and co-benefits is also needed to streamline access to data and build the evidence base for NI collaboratively.

PERFORMANCE AND ASSESSMENT

Working at regional and watershed scales ("Scale matters"):

Strengthening regional- and/or watershed-scale approaches to NI implementation is an important strategy to scale NI and support healthy, resilient watersheds. There are opportunities to accrue benefits and offset negative impacts when a broader landscape approach is taken at the outset. For example, work presented by the Collaborative Leadership Initiative at the forum brought together municipalities and Indigenous communities to identify and implement several NI priorities at a regional scale. Rather than a patchwork of NI projects, there are opportunities to work together across jurisdictions if equipped with the right policy and governance drivers, as well as tools for collaboration and shared decision making (e.g., models, metrics). Watershed data—for example, flow and/or water quality—can also inform building and effectively monitoring more resilient and interconnected infrastructure systems.

Embed within practice ("Set standards and targets"):

A key challenge for building a better business case for NI across the Prairies relates to setting targets for performance and ensuring adequate data to track performance in relation to those targets. For example, for projects interested in biodiversity co-benefits, there are often inadequate performance data and targets to inform assessments. In benefit categories with more straightforward performance metrics, like non-point source water quality, the paucity of monitoring data can be a significant challenge. Setting realistic targets can help direct and prioritize efforts, while the ability to show progress over time can lead to more deliberate actions and could help formally guide design and evaluation for different NI types.

Additionally, many stakeholders expressed a need for more guidance documents to inform local decisions about NI and to formally guide NI design and evaluation across the identified benefit categories (e.g., water treatment, flood protection). For example, Simoes et al. identified that even just small shifts in design philosophy for NI, like naturalized stormwater basins, could prevent the omission of co-benefits from design and optimization. The creation of standards is another important avenue to mainstream NI within practice and to ensure that minimum levels of performance are achieved. Moudrak and Feltmate list several guidelines and standards applicable to NI, such as bioretention systems, but this type of information is not available for all NI types or covers all types of threats. For example, NI that protects against flooding, like water retention, may be designed to withstand an event with exceedance probability in excess of 100 years, but such recommendations to provide resilience in the face of drought are not as well defined.

FUNDING AND VALUATION

Strengthening the use of economic valuation of NI ("Economics is king"):

Economics is a powerful driver of decision making. There is a need to assess the financial value of the benefits of NI and natural assets to better engage decision-makers, particularly municipalities. Making the economic benefits of investing in NI more visible on balance sheets and in regulatory and funding decisions is a key avenue for moving forward; however, there is a need for agreed-upon tools and methodologies, and the development of clearer guidance and support for NI proponents to build the economic case. Conducting applied economic valuations for potential NI projects on the Prairies is a practical way forward, leveraging tools like IISD's Sustainable Asset Valuation (SAVi) approach, Sustainable Technologies Evaluation Program's Low Impact Development Life Cycle Costing Tool, or the Climate Risk Institute's Risk Return on Investment tool, among others.

Equip funders with tools to understand the return on investment of NI ("Inform funding and evaluation"):

Funding agencies (including levels of government) can better share data and their approaches to measuring performance and prioritizing project funding. However, there is a need for simple tools for funders to evaluate the economic value and total societal benefits of NI to better direct their investments for most impact. IISD worked with the Manitoba

Habitat Heritage Corporation (MHHC) to develop the purpose-built Conservation Trust Outcome Assessment Tools, which enables MHHC to better prioritize between projects and to provide ecological goods and services accounting. In this instance, no existing off-the-shelf tool was available to MHHC to provide this service using data tailored specifically to the Prairies. Future dialogue among public and private funders of NI could help accelerate investment, informed by better accounting of the return on investment of NI either financially or in terms of ecological goods and services.

IMPLEMENTATION AND ENGAGEMENT

Build capacity by investing in people and involving local networks ("Support people and networks")

Participants of the forum clearly flagged the need to strengthen capacity across the Prairies for planning, implementing, and evaluating NI. This would include equipping key professional groups (e.g., planners, asset managers, engineers, landscape architects) with training, tools, and resources that would support the execution of NI implementation. Working to include people and community-based organizations (e.g., watershed groups, municipal champions, advocacy groups, citizen science) supports contextually informed decision making and builds a foundation of local support for NI.

Bridge worldviews and address equity ("Two-Eyed Seeing")

Economic value alone does not shape the business case for NI. Many disciplines and ways of knowing—for example, Indigenous and Local Knowledge, science, technology, engineering and mathematics, economics, and social sciences—can inform understanding of the "value" or "values" of NI, and to develop solutions that match local needs. In alignment with Canada's National Adaptation Strategy, the implementation of NI should "Respect jurisdictions and uphold Indigenous rights" and "Advance equity and environmental justice." Through this lens, there is much to learn from the Two-Eyed Seeing approach, which integrates the strengths of Indigenous ways of knowing in one eye and the strengths of mainstream ways of knowing with the other (Prairie Climate Centre, 2021).

For those interested in reviewing the raw outputs of the final breakout session, the impact-effort boards produced during the forum were digitized and can be found in Appendix B.

3.0 Field Tour (Day 2)

(Photo: Christian Pe Benito/IISD)

The substantive discussions of the forum continued on the road, in the field, and across Southern Manitoba. Participants visited a range of NI sites to discuss their water-related infrastructure outcomes, co-benefits, and metrics that support performance tracking. Each stop on the tour featured expert presentations and discussions about the function and performance of the site.

The field tour visited the sites listed in Table 1.

Table 1. Tour sites and descriptions

Tour location	Tour description
John Hirsch Place	Overview of a strata soil retention drainage system in downtown Winnipeg presented by Darren Swanson (Novel Futures)
Canadian Museum for Human Rights	Overview of a green roof and rainwater harvesting system in downtown Winnipeg presented by Dave Noseworthy (Canadian Museum for Human Rights)
Sage Creek	Overview of naturalized stormwater ponds and native grasslands within a Winnipeg residential neighbourhood presented by Pascal Badiou (Ducks Unlimited Canada) and Ashley Rawluk (IISD)
Duff Roblin Provincial Park Floodway Inlet	Overview of the Red River Floodway, which protects the City of Winnipeg, presented by Erika Collet (Manitoba Transportation and Infrastructure) and commentary on the NI continuum facilitated by Anton Skorobogatov (MAGNA Engineering Services Inc)

Tour location	Tour description
St. Geneviève	Overview of ongoing research at a water-retention system located in Southern Manitoba presented by Joey Simoes (IISD)
Grand Marais	Overview of a lagoon and wetland system situated near the south shore of Lake Winnipeg presented by Darcy Henderson (Rural Municipality of St. Clements)
Brokenhead Wetland Ecological Reserve	Overview of a natural wetland system and interpretive trail presented by Paul Chief (Brokenhead Ojibway Nation) and Smudge Ceremony facilitated by Elder Glenda Smith (Brokenhead Ojibway Nation)
East St. Paul	Overview of a deployed floating treatment wetland system within a residential stormwater basin presented by Richard Grosshans (IISD)

3.1 Tour Highlights

Naturalized Stormwater Ponds Are the Norm in Winnipeg Developments

Ladco and Native Plant Solutions collaborated to build the first naturalized stormwater pond in the 2000s, designed to mimic wetlands and surrounded by native vegetation. Realizing the many benefits compared to conventional stormwater ponds, naturalized stormwater ponds are the preferred standard for stormwater management by the City of Winnipeg. Benefits include improved water quality, decreases in nuisance algae and invasive weeds, fewer Canada geese, lower greenhouse gas emissions, lower annual maintenance costs (1/5 of costs for conventional pond), and more community access to natural areas (Koblun & Ross, 2017).

(Photo: Christian Pe Benito/IISD)

"Natural" Naturalization

Participants discussed the spectrum of infrastructure solutions, from grey to hybrid to exclusively NI. There was a lively discussion about whether the Red River Floodway is considered natural infrastructure, and a live poll found that most participants consider the floodway to be hybrid infrastructure. They questioned if a grassed ditch should be considered NI, or if it would better represent NI to have more natural features like bends, meanders, and wildlife habitat to increase co-benefits. A quarter of participants viewed the Red River Floodway as just an artificial channel that has drastically changed the landscape.

What Type of NI Is the Red River Floodway?

74% identified the floodway as hybrid infrastructure, the other 26% as grey.

The "idea of natural" was further questioned. A concrete ditch will provide an infrastructure outcome, but participants wondered just how many additional changes need to be incorporated before it is naturalized. In some instances, projects become naturalized without original intent, suggesting that in project design, we can "create the right canvas to create opportunities for nature to come in and do its own thing." As systems mature, vegetation (either encroaching from the surrounding landscape or planted) will respond, finding and establishing in areas that meet its habitat requirements.

(Photo: Christian Pe Benito/IISD)

If the Red River Floodway were built today, based on our evolving understanding of NI, would the design incorporate more natural features?

Retention Ponds Are an Effective Type of NI in Manitoba for Multiple Benefits

(Photo: Christian Pe Benito/IISD)

These types of water-holding systems are increasingly common, particularly since water-retention projects are funded through Manitoba's Conservation and GROW Trusts (ongoing) and Manitoba Agriculture's Ag Action Program (currently closed). Ten retention ponds have been built by the Seine Rat Roseau Watershed District in the last few years alone. There has been a lot of satisfaction since transitioning from initially promoting retention projects with Pelly's Lake in 2010, to the monitoring and evaluation on the growing number of projects today. IISD's work at De Salaberry and St. Geneviève (Simoes et al., 2022) will help develop the protocols that others can use to improve the design and management of similar sites.

The IISD CBA on retention ponds (Puzyreva et al., 2022) indicated that the construction cost of these projects is quite high and that agricultural producers would not build them without funding. These projects are well received by the local community, as they support better grazing and increased livestock production, as well as reduce flood damage to municipal roads. However, while the value that these systems contribute to flood avoidance is known, their quantification is difficult without sophisticated analysis or modelling. Retention ponds and corridors have allowed First Nations communities to safely fish for suckers, a traditional food source. Without this NI, the increased peak flows would make it too dangerous to fish.

(Photo: Christian Pe Benito/IISD)

(Photo: Christian Pe Benito/IISD)

There is value in communicating the performance of NI, including retention ponds, to insurers. By understanding that landowners or municipalities have implemented actions to reduce the risk of flooding, perhaps insurance premiums could be lowered, reducing community vulnerability and encouraging greater uptake of NI.

Strengthening Partnerships With First Nations

First Nations communities value relationships and trust with their partners. These can take time to build and must be accounted for when building projects and budgets. Success and trust can come from intentional actions, like hiring local community members to work on NI projects and trusting the community to take the lead on design and implementation. It is important to look beyond our typical metrics of interest to indicators that are important to the community (e.g., the planting location of traditional plants and ease of accessibility).

The need for adaptation action is urgent, yet any action taken that involves or affects Indigenous communities must start with relationship building. Indigenous communities often already have a long-term understanding of the challenges that need to be addressed, and in those cases, may be keen to get started. Begin relationship building early on, so you will have that foundation when project funding becomes available.

References

Alternative Land Use Services. (2022). *The Modeste natural infrastructure project.* https://alus.ca/wp-content/uploads/2022/04/Modeste-Natural-Infrastructure-Project_ALUS_2022.pdf

Bassi, A.M., Pallaske, G., & M. Stanley. (2019). *An application of the Sustainable Asset Valuation (SAVi) Methodology to Pelly's Lake and Stephenfield Reservoir, Manitoba, Canada.* International Institute for Sustainable Development. https://www.iisd.org/system/files/publications/savi-pellys-lake-stephenfield-canada-en.pdf

Canadian Council of Ministers of the Environment. (2021). *Natural infrastructure framework: Key concepts, definitions and terms.* https://ccme.ca/en/res/niframework_en.pdf

Centre for Indigenous Environmental Resources. (2022). *Collaborative leadership initiative: Reconciliation in action.* https://secureservercdn.net/45.40.150.109/b6b.b6a.myftpupload.com/wp-content/uploads/2022/04/CLI-backgrounderNEW.pdf

CEO Water Mandate, Pacific Institute, The Nature Conservancy, Danone, & LimnoTech. (n.d.) *NBS benefits explorer.* https://nbsbenefitsexplorer.net/

City of Calgary. (2021). *Valuation of natural assets: Analysis summary.* https://hdp-ca-prod-app-cgy-engage-files.s3.ca-central-1.amazonaws.com/6616/5369/8199/Natural_Asset_Valuation_Summary.pdf

City of Minneapolis. (2021). *City of Minneapolis sustainable building policy: City owned and operated buildings.* https://www2.minneapolismn.gov/media/content-assets/www2-documents/departments/Municipal-Owned-and-Operated-Sustainable-Building-Policy.pdf

Climate Risk Institute. (2019). *Risk and return on investment tool.* https://climateriskinstitute.ca/rroit/#:~:text=The%20Risk%20and%20Return%20on%20Investment%20Tool%20(RROIT)%20is%20a,manage%20their%20flood%2Drelated%20risks.

Government of Alberta. (2013). *Alberta wetland policy.*

Government of Canada. (2022). *Canada's national adaptation strategy.* https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/national-adaptation-strategy/national-adaptation-strategy.pdf

International Institute for Sustainable Development. (2022). *Natural infrastructure for water solutions (NIWS).* https://www.iisd.org/projects/natural-infrastructure-water-solutions-niws

International Institute for Sustainable Development. (2023). *Sustainable asset valuation.* https://www.iisd.org/savi/

Koblun, G., & L. Ross. (2017). *Urban stormwater management workshop: Part 1: Naturalization strategies & solutions introduction.* Native Plant Solutions. http://srrcd.ca/wp-content/uploads/2017/05/Stormwater-Workshop-Steinbach-MB-March-2017-Part-1-and-2-Final.pdf

Moudrak, N., & Feltmate, B. (2020). *Under one umbrella: Practical approaches for reducing flood risks in Canada.* Intact Centre on Climate Adaptation, University of Waterloo. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2020/11/Under-One-Umbrella-1.pdf

Prairie Climate Centre. (2021). *Manitoba climate resilience training project - An initiative of BRACE.* https://mcrtproject.ca/

Puzyreva, M., Zhao, J., Patel, B., Simoes, J., Rawluk, A. (2022). *The value of water retention beneficial management practices to farmers and landowners in the Seine Rat Roseau Watershed District.* https://www.iisd.org/system/files/2022-12/water-retention-practices-seine-rat-roseau-watershed-district.pdf

Shiao, T., Kammeyer, C., Brill, G., Feinstein, L., Matosich, M., Vigerstol, K., and Müller-Zantop, C. (2020). *Business case for nature-based solutions: Landscape assessment.* United Nations Global Compact CEO Water Mandate and Pacific Institute. www.ceowatermandate.org/nbs/landscape

Simoes, J., Grosshans, G., Rawluk, A. (2022). *Summary of the 2022 International Institute for Sustainable Development Canadian Prairie Water Retention Monitoring and Modelling Workshop.* https://www.iisd.org/publications/report/canadian-prairie-water-retention-workshop

Strategic Systems Engineering. (2022). *PhosFinder fact sheet.* https://strategicsystemsengineering.ca/wp-content/uploads/2022/01/Phosfinder_fact_sheet_for_distribution.pdf

Sustainable Technologies Evaluation Program. (2019). *Low impact development life cycle costing tool.* https://sustainabletechnologies.ca/lid-lcct/

Tozer, L., Mettler, C., Neeson, E., Reyes, R. S., Morgan, A., & Amon, E. (2022). *Pathways to living cities.* https://greencommunitiescanada.org/wp-content/uploads/2022/11/Living-Cities-Framework-Final.pdf

Appendix A. List of Day 1 Forum Attendees (With Affiliations)

Anna Cole	City of Saskatoon
Anton Skorobogatov	MAGNA Engineering Services Inc.
Anuj Kathuria	Winnipeg Metropolitan Region
Ashley Rawluk	International Institute for Sustainable Development
Bryan Page	Ducks Unlimited Canada
Cary Hamel	Nature Conservancy of Canada
Chelsea Lobson	Lake Winnipeg Foundation
Chris Rol	Insurance Bureau of Canada
Dan Cox	Manitoba Association of Watersheds
Darren Swanson	Novel Futures
David Seeliger	MPE Engineering, Alberta Low Impact Development Partnership
Dimple Roy	International Institute for Sustainable Development
Duane Nicol	City of Selkirk
Duncan Morrison	Manitoba Forage and Grassland Association
Emily Kroft	International Institute for Sustainable Development
Gregg Brill	Pacific Institute
Harpreet Sandhu	City of Calgary
Hank Venema	Strategic Systems Engineering
Henry Wilson	Agriculture and Agri-Food Canada
Joanna Eyquem	Intact Centre on Climate Adaptation
Joey Simoes	International Institute for Sustainable Development
Josée Méthot	International Institute for Sustainable Development
Lara Ellis	ALUS Canada (past)
Leta van Duin	Alberta Low Impact Development Partnership
Liese Coulter	Natural Assets Initiative

Lynda Nicol	Manitoba Association of Watersheds
Madeline Stanley	International Institute for Sustainable Development
Marina Puzyreva	International Institute for Sustainable Development
Mark Lee	Manitoba Government
Mary Ellen Shain	North Saskatchewan Watershed Alliance
Mathew Langford	EPCOR
Meghan Thomson	Manitoba Habitat Heritage Corporation
Mike Gallant	Kerr Wood Leidal Associates Ltd.
Monique Dietrich	Alberta Environment and Parks
Nadine Stiller	Environment and Climate Change Canada
Pascal Badiou	Institute for Wetland and Waterfowl Research, Ducks Unlimited Canada
Paul Chief	Brokenhead Ojibway Nation
Petra Kiwan	International Institute for Sustainable Development
Richard Grosshans	International Institute for Sustainable Development
Richard Farthing-Nichol	Centre for Indigenous Environmental Resources
Rod Ruff	Alberta Ecotrust Foundation
Roy Brooke	Natural Assets Initiative
Ryan Litovitch	Winnipeg Metropolitan Region
Samantha German	Manitoba Habitat Heritage Corporation
Scott Millar	North Saskatchewan Watershed Alliance
Sumeep Bath	International Institute for Sustainable Development
Sung Joon Kim	Manitoba Government
Thomas Saleh	International Institute for Sustainable Development
Todd Scaletta	Certified Professional Accountants of Alberta
Twyla Kowalczyk	Associated Engineering
Ute Holweger	Environment and Climate Change Canada
Yannis Kachani	Infrastructure Canada

Appendix B. Breakout Session Impact Matrix

Figure B1. Wetlands and floating treatment wetlands

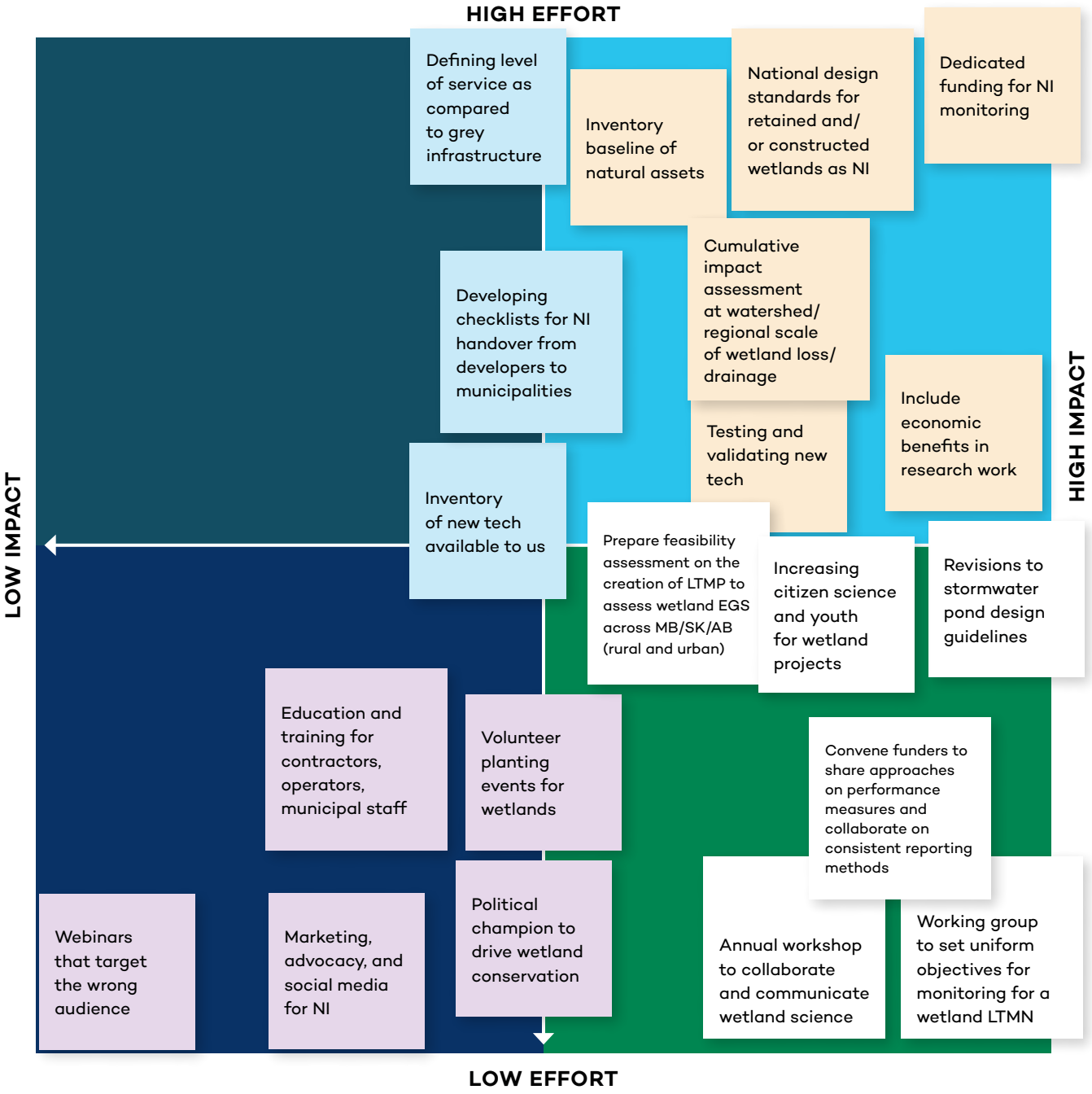


Figure B2. Water retention and flood bypass

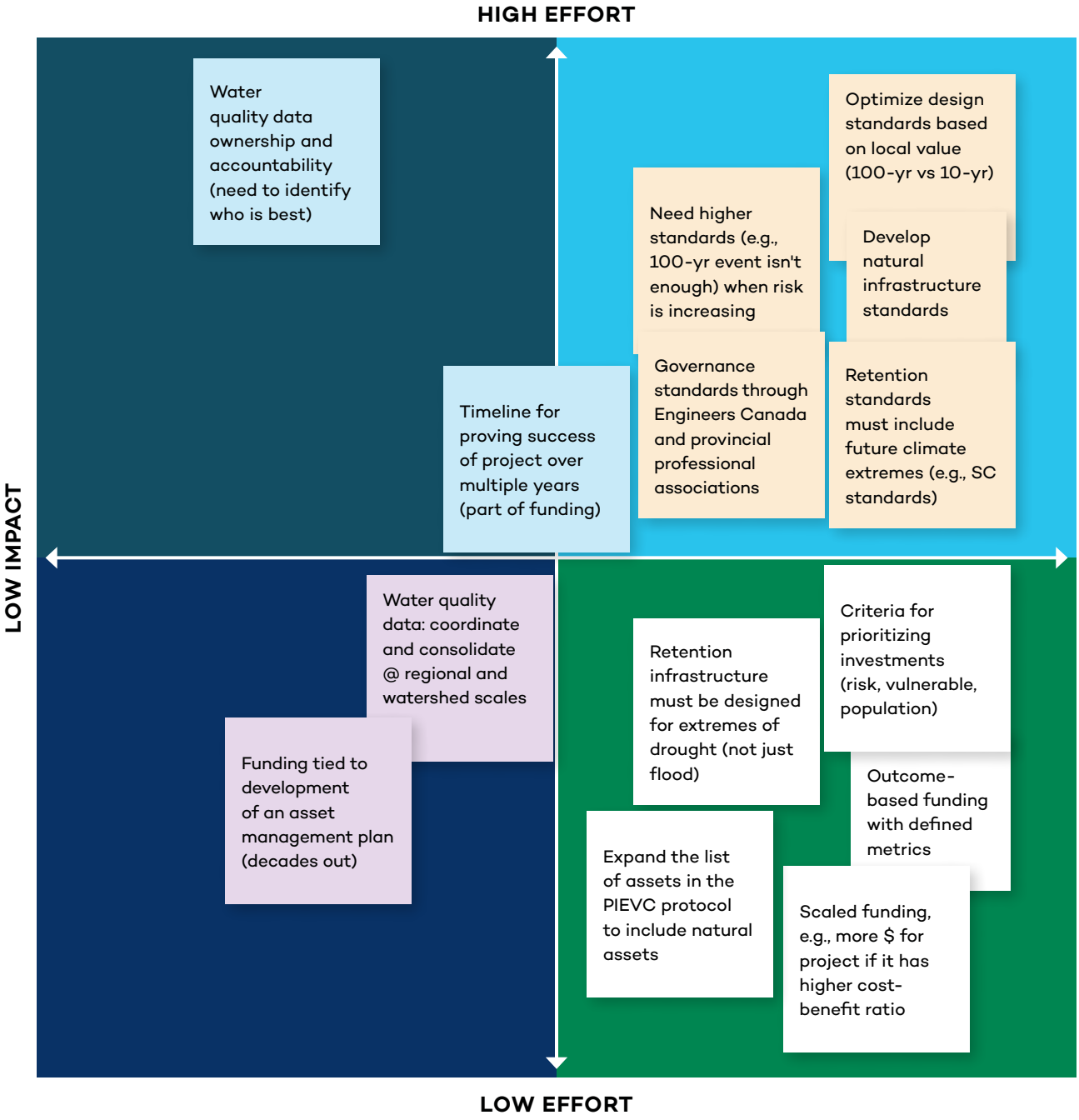


Figure B3. Ecosystem conservation and restoration

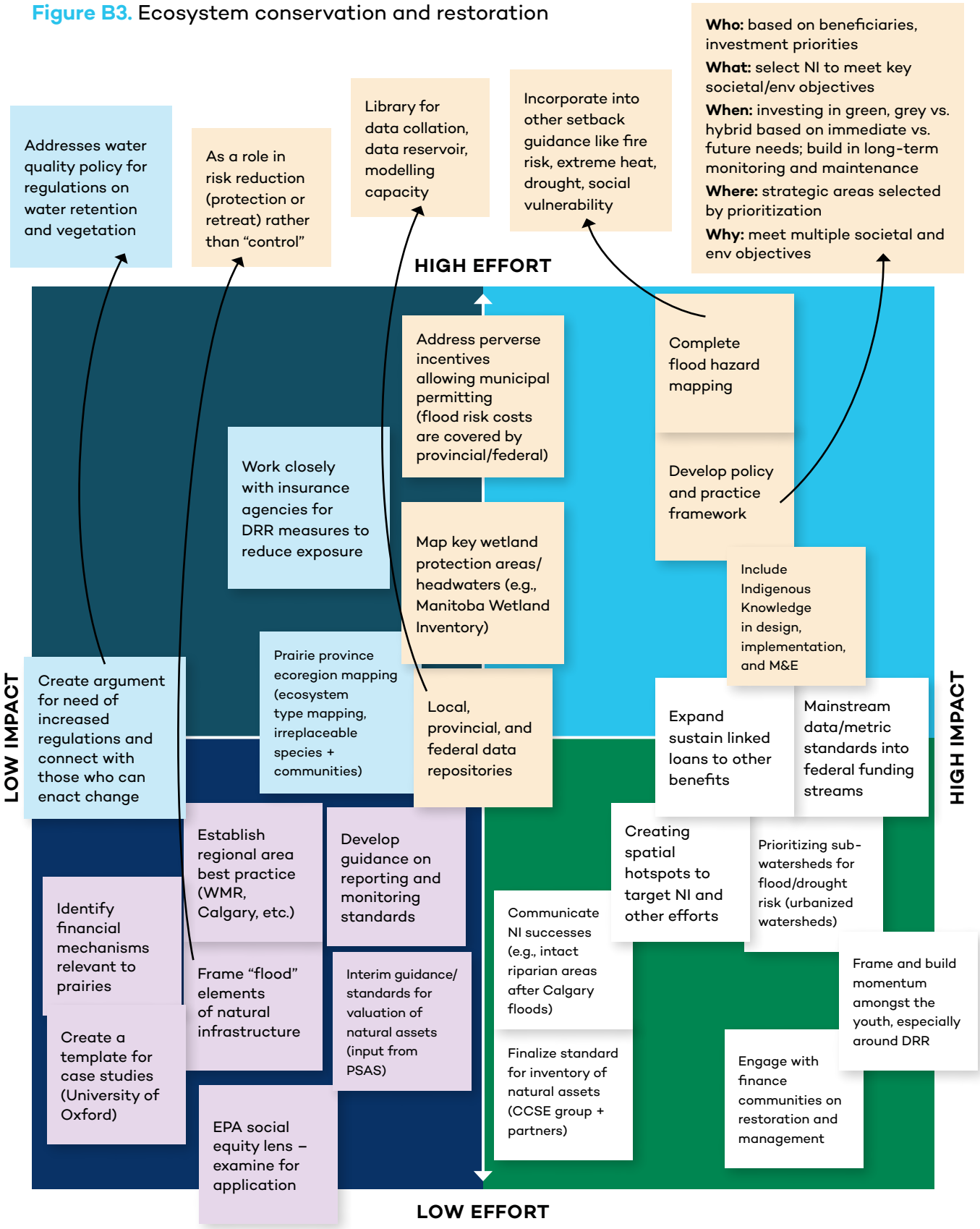


Figure B4. Urban natural infrastructure

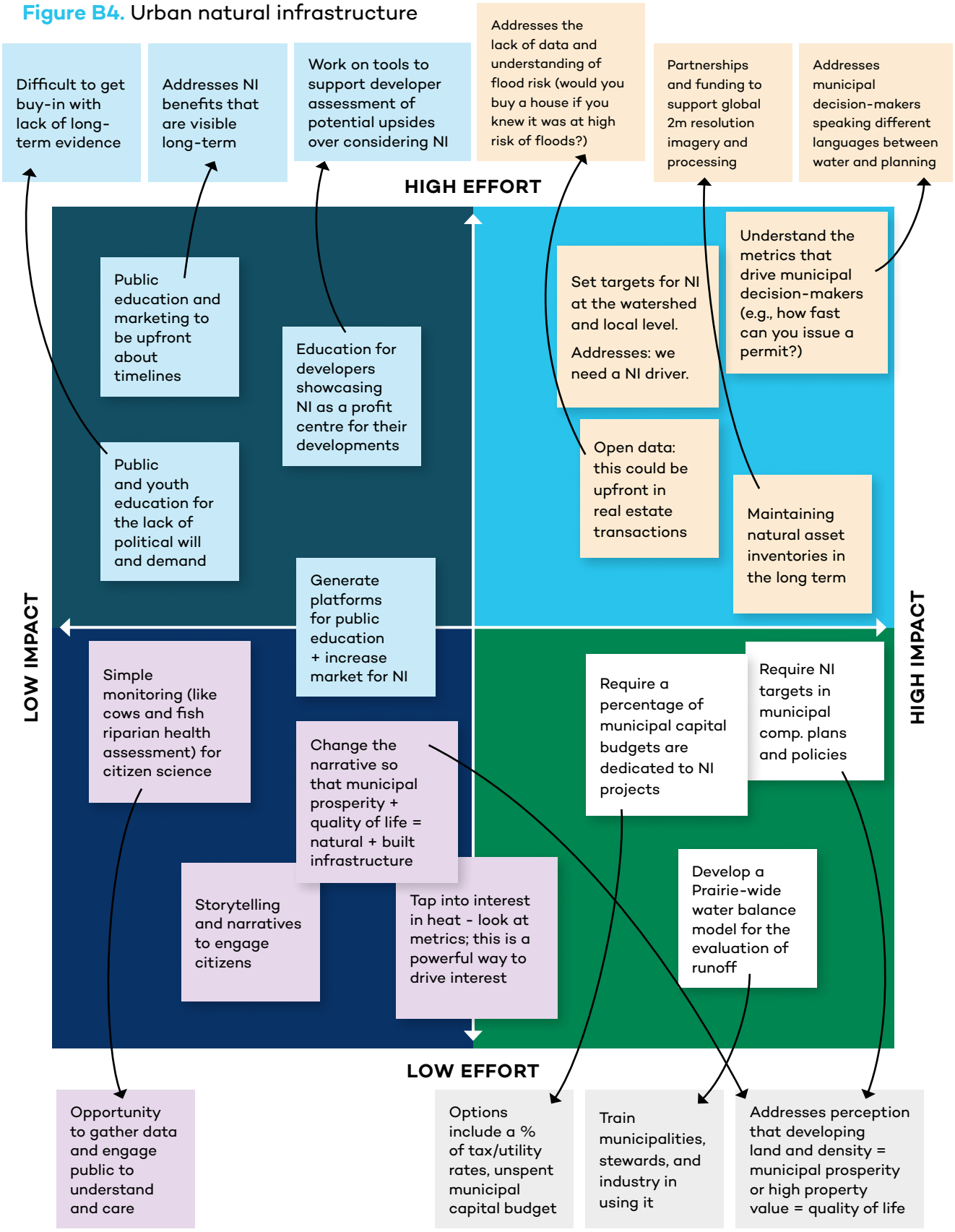


Figure B5. General natural infrastructure

Note: Impact and effort not considered in virtual session.

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