
Summary Document and Preliminary
Roadmap for the Workshop:
“Advancing Municipal Natural
Infrastructure Management in Alberta”

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PUBLIC REPORT

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WORKSHOP DESCRIPTION

On September 19-20, 2019 at The City of Calgary’s Water Centre, InnoTech Alberta, The City of Calgary, and The City of Edmonton held a workshop to advance municipal natural infrastructure management in Alberta (“the workshop”). The purpose of the workshop was to equip Alberta local governments with an understanding of the emerging evidence on municipal natural infrastructure management and develop a roadmap to expand the practice in Alberta based on local context. This was achieved by bringing together local governments and experts to share experiences and best practices and co-develop a roadmap to embed consideration of natural infrastructure into municipal decision-making. A summary of the workshop and a preliminary roadmap, based solely on workshop discussions and presentations, is provided in this report.

The following Alberta municipalities attended the workshop:

The City of Airdrie

Municipal District of Brazeau County

The City of Calgary

The City of Chestermere

The Town of Cochrane

The City of Edmonton

The City of Lethbridge

The Town of Okotoks

Municipal District of Parkland County

Municipal District of Red Deer County

Municipal District of Rocky View County

Municipal District of Taber

A list of all participants and their organizations is in provided in Appendix B.

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WORKSHOP REPORT

1.1 INTRODUCTION TO THE ADVANCING MUNICIPAL NATURAL INFRASTRUCTURE MANAGEMENT IN ALBERTA WORKSHOP

Natural infrastructure and the services they provide are a fundamental part of municipal infrastructure. A growing number of local governments are incorporating natural infrastructure into core decision-making and asset management processes. Evidence shows that this can save money, reduce risk and result in cost-effective and reliable service delivery.

Best practices and gaps are emerging as municipalities learn more about how to assess and incorporate natural infrastructure in planning and asset management decisions.

In Alberta, there is an opportunity for communities to learn from these experiences, relate them to local contexts, and develop a roadmap towards strong and consistent approaches to municipal natural infrastructure management that can easily be adopted across the province.

The workshop goal was to equip Alberta local governments with an understanding of the emerging evidence on municipal natural infrastructure management and to develop a roadmap to expand the practice in Alberta based on local context.

The goal was achieved by bringing together local governments and experts to share experiences and best practices; and, in co-developing this roadmap to embed natural infrastructure considerations in municipal decision-making.

1.2 SUMMARY DISCUSSION ON THE MUNICIPAL NATURAL INFRASTRUCTURE MANAGEMENT CONTEXT

1.2.1 General

Natural infrastructure can assist in delivering core local government services that would otherwise need to be delivered by engineered assets. For example, healthy forests and wetlands can help to manage stormwater and reduce flooding risks.

Accordingly, a growing number of Canadian local governments are beginning to understand, measure and manage natural infrastructure not only for ‘green’, social, or recreational benefits, but also for their role in core service delivery. They are often using the same asset management tools as for traditional engineered assets.

Natural Infrastructure was defined in the workshop to ensure a common understanding:

Municipal natural infrastructure is the range of assets from natural landscapes through engineered solutions that harness ecological and hydrological processes and that provide services and other resilience benefits.

Some examples include wetlands, rivers, stormwater ponds, urban parks, bioretention, green roofs, and permeable pavement.

1.2.2 Additional Context for Natural Infrastructure Management

Additional context for natural infrastructure management includes:

Many services that local governments provide, including drinking water provision, wastewater treatment, and stormwater management depend on engineered assets that are aging and need renewal. One-third of Canadian infrastructure is in fair, poor to very poor condition.¹

Climate change, through more frequent and severe weather events, is straining local municipalities through increased utilization or damage to engineered infrastructure and contributing to increased

¹ http://canadianinfrastructure.ca/downloads/Canadian_Infrastructure_Report_Card_Key_Messages_2016.pdf

costs.² For example, in 2017 in Alberta, 4.7 million cubic metres of raw sewage overflowed from combined sewer systems, suggesting that existing stormwater and wastewater management systems are not handling downpours effectively.³

Research and practice from a variety of sources outline a positive case for natural infrastructure management. Examples cited during the workshop include:

- In the Town of Gibsons, B.C. natural ponds provide stormwater management services that would cost \$3.5M-\$4.0M to replace.⁴ Acting on this allowed the Town to reduce development cost charges at one site by over 70%;
- MNAI pilots show that natural infrastructure has substantial value that increases under climate change scenarios because they are more resilient than other infrastructure solutions. Replacement value of stormwater services provided by wetlands in two Credit Valley sub-watersheds, for example, is estimated to be ~\$704 million under current conditions, and ~\$764 million under climate change conditions.⁵
- Other MNAI projects provide information on the value of natural assets that communities can leverage in policy and planning to ensure that services are not compromised, degraded or lost. The City of Courtenay was provided as an example of a municipality that is considering natural infrastructure in decision-making:
 - They have included climate change considerations in throughout their official community plan (OCP).
 - They are using a triple-bottom line approach to budgeting through a MNAI developed process and lens.
 - They are working with the Insurance Bureau of Canada and municipal insurance agencies to discuss what level of risk is acceptable. Courtenay has also been able to view how they could “transfer liability” in the event of a 1 in 200-year event where grey infrastructure cannot manage these impacts.

² https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_ExecSumm-EN-040419-FINAL.pdf

³ <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810010001>

⁴ https://mnai.ca/media/2018/01/TownofGibsons_CaseStudy.pdf

⁵ <https://mnai.ca/where-are-they-now-peel/>

- Courtenay is working with MNAI on a multi-stakeholder watershed assessment (looking at the watershed catchment area) for an upstream lake (Comox) which provides drinking water for the region.
- The District of West Vancouver completed an inventory of natural assets and calculated a corresponding service value of approximately \$3.215 billion.
- The City of Vancouver faces water-related challenges and the Organization Economic Cooperation and Development ranked the City 11th in the world for infrastructure vulnerability. The cost to replace all combined sewers⁶ to reduce sewage discharge would be prohibitive. The City has reconceptualized the challenge: instead of focusing on separated sewers alone, it is *ensuring that less stormwater enters the sewer system in the first place* through natural infrastructure solutions to store and absorb water. The *Rain City Strategy* provides a system-wide green infrastructure approach and was approved by Vancouver City Council in November 2019.

1.2.3 Enabling Conditions

The “enabling conditions” which support natural infrastructure management are beginning to evolve.

Examples cited during the workshop include:

Financial reporting. The Public Sector Accounting Handbook currently limits the consideration of natural assets within public sector financial statements. However, the Public Sector Accounting Board (PSAB) has received recommendations to increase the recognition of natural assets in Canadian public sector accounting standards, and this may ultimately lead to changes in accounting guidance. In the interim, Gibsons, BC has provided initial guidance on financial planning and reporting for natural assets that takes into account the Public Sector Accounting Handbook restrictions.⁷ With approval from their auditor, West Vancouver has included natural assets in their financial statements, including 20-year projected maintenance costs. West Vancouver plans to include those natural assets into future decision-making and monitor and update their values over time.

⁶ https://en.wikipedia.org/wiki/Combined_sewer

⁷ <https://mnai.ca/media/2018/01/GibsonsFinancialPlanningReport-WEB.pdf>

Professional guidelines. MNAI has researched and provided initial guidance to professional planners in Ontario on integrating natural assets into planning; and is developing, with Engineers and Geoscientists of BC and others, a project that is anticipated to lead to new professional practice guidelines for professional engineers in BC and beyond. Ryan O’Grady from Courtney BC sits on the Sustainability Committee of Engineering & Geoscientist British Columbia (EGBC), a provincial engineering body. Ryan works with MNAI and Asset Management BC, and they have created an agreement in principal to develop a natural asset management practice guideline. This would lead to significant recognition of natural assets throughout professional practice bodies.

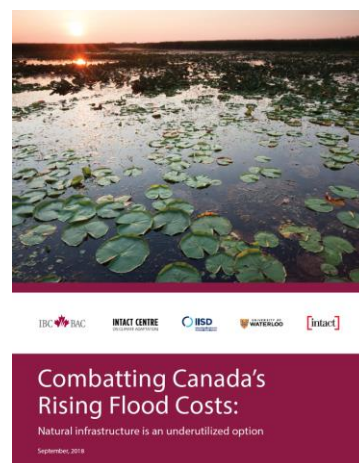
Funding. The federal government has several substantial funding sources for natural assets. The *Disaster Mitigation and Adaptation Fund* (DMAF), for example, explicitly includes natural infrastructure to provide adaptation or mitigation services to the gradual and/or sudden impacts of climate change or natural hazards, and allows for the bundling of several sub-projects within a single watershed. Recently funded projects in Canada that include substantial natural infrastructure components include the Region of York and City of Grand Forks.⁸

A changing enabling environment:
Grand Forks BC, using outputs from an MNAI project, received \$49M from the federal DMAF fund for work including restoration of wetlands and riparian area to reduce flooding risks after two devastating flooding seasons. Once complete, the project will increase the flood resilience of over 800 residents during spring thaws and other extreme weather

1.3 SUMMARY: DRIVERS FOR NATURAL INFRASTRUCTURE MANAGEMENT IN ALBERTA

Factors that are prompting local governments in Alberta specifically to embed natural infrastructure into corporate decision making and asset management processes” include:

Risk management, climate change and corresponding disasters. The Southern Alberta Flood 2013, increased and more severe snowstorms, droughts, and fires were all cited as examples of the sorts of disaster risks that are causing local governments to reconsider the role and importance of natural infrastructure. Informed decision making that



⁸ See BFRE.ca for press release and details on Grand Forks

takes full account of natural infrastructure in service delivery is a related theme.

Insured and uninsured losses. Closely related to increasing climate risk, participants noted that: not all flood loss damage is insurable; insurers are retreating from providing coverage for high risk areas; and losses are growing.

Insurance Industry Drivers:

The Insurance Bureau of Canada states that increase in property and casualty insurance losses is indicative of the growing costs associated with climate-related events. These losses averaged \$405 million per year between 1983 and 2008, and \$1.8 billion between 2009 and 2017. Water damage is the key driver behind these growing costs. (<http://assets.abc.ca/Documents/Resources/IBC-Natural-Infrastructure-Report-2018.pdf>)

Complementary local government agendas. Many Alberta communities have prioritized issues such as green space, biodiversity, connectivity, resilience, adaptation and climate change mitigation. These are not necessarily conceptualized or communicated in terms of natural infrastructure, but healthy natural infrastructure systems support these outcomes.

Leveraging. Municipal governments in Alberta are interested in the efficiencies and benefits that other local governments in Canada are realizing from using natural infrastructure management approaches.

Adopting best practice and innovating in service delivery. Some Alberta communities are undertaking plans and/or processes related to growth, land stewardship, stormwater management and other issues. They are aware of growing local, natural and international interest in solutions based on healthy natural assets and see benefits in exploring their role in the context of these plans and processes.

Asset management, or service vs. asset. Many local governments in Alberta are embarking upon modern, structured asset management. This is oriented around the concept of service delivery, rather than the specific asset delivering the service. Local governments are interested in the extent to which natural

infrastructure can provide core services costs-effectively and reliably instead of, or as a complement to, traditional engineered solutions.

Lifecycle costs. Related to asset management, evidence shows that natural infrastructure can have lower overall costs compared with grey infrastructure when capital expenditures, operating costs, and renewal costs are taken into consideration.

Co-benefits. Natural infrastructure is acknowledged to provide benefits in addition to core municipal services, such as biodiversity, positive physical and mental health-related outcomes, increased/improved recreational areas, and heat island reductions. Core services can be addressed with natural infrastructure as well as the provision of secondary benefits; for example, a park can provide recreational benefits and at the same time stormwater management services.

Agricultural run-off and related opportunities to manage it better through natural asset management solutions were discussed.

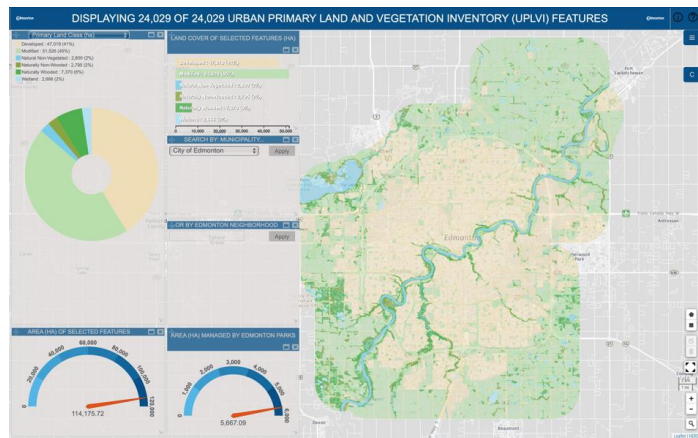
Agricultural stewardship. Strong support from the ranching community for effective land stewardship and the desire to pass along healthy landscapes was noted.

1.4 SUMMARY: NATURAL INFRASTRUCTURE ACTIVITIES UNDERWAY IN ALBERTA

A wide range of natural infrastructure management activities are already underway in Alberta. These form an important starting point for efforts to accelerate practice.

Examples cited by workshop participants include:

- City of Calgary’s BiodiverCity Strategy, Riparian Action Program; Green Roof Report to Council; and, the Climate Resilience and Resilient Calgary Strategies reference natural infrastructure and related work to address identified stresses and shocks;
- The City of Edmonton’s mapping efforts, which provide detail on land-cover across the city; and, public engagement on its Natural Areas Plan; The City has also secured an extensive network of natural areas that include the North Saskatchewan River Valley, associated ravines, tableland wetlands and upland forests. These natural areas, in combination with



An image from Edmonton’s urban Primary Land and Vegetation Inventory, one of the many existing natural infrastructure-related projects in Alberta.

semi-natural areas, are the foundation of Edmonton’s ecological network – a key natural City asset that conserves both the region’s natural biodiversity and local ecological services. To effectively manage the natural areas network, The City uses a vegetation database called the “urban Primary Land and Vegetation Inventory (uPLVI);

- Cochrane’s ‘naturescaping’ and xeriscaping efforts as well as updated landscaping bylaws;
- Airdrie’s data collection on assets as well as other asset management teams and systems within many of the participating local government are established;
- Policies and plans in many of the participating local governments related to watershed, land use and wetlands;
- GIS information, mapping and data in many of the participating local governments; in not-for-profits such as the North Saskatchewan Watershed Alliance; and in utilities such as EPCOR, which have focused on mapping tributaries;
- Watershed based collaboration initiatives, including, for example, the North Saskatchewan Watershed Alliance, which collaborates with a diverse range of stakeholders to find solutions to watershed issues;
- Programs such as those undertaken by ALUS to encourage farmers to protect marginal farm lands for the preservation of ecosystem services; and
- Organizations such as Infrastructure Asset Management Alberta (IAMA), which represents a community of people and organizations engaged in or who has an interest in infrastructure asset management. IAMA provides leadership and support for the management of community infrastructure assets. Natural assets have not been addressed by IAMA yet; however, the topic will be a focus of discussion at future IAMA workshops.

1.5 SUMMARY: BARRIERS TO NATURAL INFRASTRUCTURE MANAGEMENT IN ALBERTA

A range of barriers to natural infrastructure management in Alberta were identified by participants including:

- **Regulations/incentives.** Regulations that may indirectly encourage the elimination of wetlands rather than to protect them. For example, the moratorium on water licensing in southern Alberta can be a barrier to wetland construction and stormwater use.

- **Environmental Policy.** An overall approach in the province that emphasizes the importance of river mainstems but not tributaries, with a corresponding lack of data, planning and action related to the latter.

"We don't have all the right answers, but we know we are on the right path."

- *Workshop participant describing their local government's natural asset management efforts*

- **Ownership and jurisdiction.** Natural Infrastructure may be on private land or under the jurisdiction of non-municipal entities, which is challenging for ongoing preservation and maintenance. There are models and tools for collaboration, but this is also acknowledged to be a complex and challenging area.

- **Cultural and perception issues.** Local governments noted that:

- In many development contexts, discussions quickly default to discussions about tree removal and corresponding compensation rather than discussions about the potential value of preserving trees; and
- Natural infrastructure can be perceived as a new and/or challenging area within some local governments because there are additional challenges with operations and maintenance and with valuing the benefits of natural infrastructure that do not exist with typical grey infrastructure.

- **Lack of standard approaches and/or tools.** Participants noted the lack of standard approaches for natural asset management and most sub-components including developing inventories, valuation, and financial reporting. Challenges and/or a lack of tools to quantify risks and benefits was also cited.

- **Capacity.** It was noted that many smaller Alberta local governments lack staff capacity and resources for natural infrastructure management actions such as for conducting inventory and condition assessments or for changing operations and maintenance practices.

- **Enforcement of existing regulations** that may make it inadvertently difficult to protect natural areas.

- **Fostering collaboration** amongst and across different disciplines and jurisdictions that may have different priorities, training, metrics and terminology.

1.6 SUMMARY: ADDITIONAL POTENTIAL BENEFITS TO NATURAL INFRASTRUCTURE MANAGEMENT

Workshop participants discussed other considerations for natural infrastructure management, including:

- **Co-benefits.** Natural infrastructure can provide core local government services as well as co-benefits that are increasingly important including improved community health outcomes and biodiversity. Understanding and measuring these co-benefits can lead to more efficient and effective investment decisions.
- **Valuations and informed decision-making.** Numerous methods for valuing natural infrastructure were presented and discussed. Workshop speakers noted that, if the value of a natural asset is not determined then the de facto value is zero; it is assumed to be abundant, and therefore may be under or over utilized. Also, understanding the value of a natural asset does not dictate any particular course of action, but it does contribute to more informed, and evidence-based decision-making.
- **Standardization.** The field of natural infrastructure management is new. There are as of yet no professional standards, guidelines or a standard approach for natural infrastructure management and its components such as inventory and condition assessment. These will evolve as the field of natural infrastructure management matures. MNAI does, however, have a methodology based on modern asset management as espoused by Asset Management BC, the Canadian Network of Asset Managers, and others, and which is in turn based on ISO standards. Furthermore, some related aspects such as methodologies for economic valuation are well defined. The District of West Vancouver’s natural asset inventory and valuation was cited as an example using proven methodologies supported by peer review.

Figure 1: Modern Asset Management Process



Source: Adapted from Asset Management BC, 2014.

Modern asset management processes, which Canadian local governments must adopt, provides an effective basis for managing natural assets.

1.7 PRELIMINARY ROADMAP: ACCELERATING NATURAL INFRASTRUCTURE MANAGEMENT IN ALBERTA

Participants noted that there is no single solution or intervention to accelerate uptake of natural infrastructure management in Alberta and that systems-level change is required. The following were identified as important priorities and components of systems change.

1.7.1 *Creating a culture of success*

- **Building on success.** The successes and achievements in Alberta to date in natural infrastructure management must be acknowledged, and future positive developments similarly celebrated. Existing programs and activities should be used as a starting place for future action.

- **“Failing fast and forward”.** Natural asset management, and modern asset management more generally, are new areas of practice. As with other, more established areas of practice, mistakes should be expected, accepted and viewed as learning opportunities.

1.7.2 *Analysis and structure*

- **Mapping activities and conducting a gap analysis.** The workshop identified, on an initial basis, activities and resources that can support natural asset management efforts in Alberta. However, a more thorough analysis of activities and opportunities would be beneficial.
- **Creating more than the sum of the parts.** Ensuring that the numerous activities underway in Alberta are amplified and/or made mutually reinforcing and/or synergistic requires additional resources and support. This could come in the form of:
 - Support for convening, networking and information sharing;
 - Additional technical support for local governments;
 - Researching and/or communicating specific themes such as the economic potential of natural infrastructure for economic diversification and employment; and
 - Creating guidelines, training and/or standardization for various aspects of natural infrastructure management.
- **Understanding organizational change management** and applying its tools and concepts.

1.7.3 *Initial infrastructure management steps*

- **“Taking the first step” in local governments.** A key first step is to start identifying natural infrastructure, their condition, services provided, and potential risks. The ability to measure, monitor, manage, restore or rehabilitate natural infrastructure presupposes that they have been identified. Rudimentary information is better as a starting point than no information.
- Additional first steps for natural infrastructure management are laid out in a primer produced by MNAI.⁹

⁹ Primer is available at: <https://mnai.ca/media/2019/06/MNAI-Org-Charts.pdf>

1.7.4 Collaborating, communicating and learning

- **Communication.** The need for enhanced communication was a point of emphasis and includes:
 - The need to share case studies of municipal natural infrastructure management; the business case; lessons learned; and any other related findings.
 - The need to frame nature as a vital asset that provides core services to local governments.
 - Communicating in ways that consider the perspective and values of the audience. For example, larger cities may be interested in case studies from other similarly sized cities; and, engineers, Councilors, developers and planners may each require different information and points of emphasis.
 - Conversations between and amongst local governments is a particularly useful way of sharing information, particularly insofar as it encourages and incentivizes continual improvement and collaboration.
 - In Alberta it can be helpful to frame natural infrastructure as a way of building resilience to risk.
 - Return on investment is important to emphasize for some audiences. It was noted that if natural infrastructure provides more benefits (e.g. core service + co-benefits), then additional investment should be acceptable as there are more benefits.
 - An inventory of natural infrastructure is an important first step for communication.
- **Education.** Specific organizations were mentioned as potentially being engaged in natural infrastructure education including:
 - Alberta Low Impact Development Partnership
 - ALUS Canada

Collaboration and Communication in Vancouver:

The City of Vancouver’s development of the Rain City Strategy highlighted the paramount importance of building understanding and buy-in across professional boundaries and disciplines by explaining natural infrastructure in terms of benefits and relevance to multiple target audiences.

- **Partnerships and collaboration.** As noted, natural infrastructure may be on private land or under the jurisdiction of non-municipal entities, therefore, partnerships and collaboration between diverse entities is required. To address this, there are:
 - Opportunities for regional governments to coordinate, support, catalyze or facilitate the efforts of local governments within regions.
 - Opportunities to participate in and share information with potentially supportive stakeholders including the Alberta Urban Municipalities Association (AUMA), Infrastructure Asset Management Alberta (IAMA), and the Federation of Canadian Municipalities (FCM).

1.7.5 Governance

- **Regulatory measures.** Participants noted the importance of regulatory measures in Alberta; Ontario’s Asset Management Regulation 588/17¹⁰ was cited as an example that could be emulated.

Asset management regulation.

Ontario was the first province to introduce a regulatory framework for municipal asset management planning. The Asset Management Planning for Municipal Infrastructure Regulation (O. Reg. 588/17) was enacted in 2017, under the Infrastructure for Jobs and Prosperity Act (2015).¹¹ This regulation provides the authority for the Province to regulate municipal asset management planning, to provide consistent best practices to asset management planning across the municipal sector, and to optimize infrastructure investment decisions.

1.8 CONCLUSION

This workshop was the first of its kind to bring multiple jurisdictions across Alberta together to discuss how natural infrastructure could be considered in municipal decision-making and service delivery. The workshop provided case studies of municipalities across Canada that have already formally integrated natural infrastructure into their decision-making and provided opportunities for Alberta municipalities to discuss their own progress. The workshop concluded with all the participants working in groups alongside subject matter leaders to discuss related topics of interest. The intent of the workshop was to increase the understanding of municipal natural infrastructure and to provide examples and other resources that would assist in moving natural infrastructure management forward in the province.

¹⁰ <https://www.ontario.ca/laws/regulation/r17588>

¹¹ <https://www.ola.org/en/legislative-business/bills/parliament-41/session-1/bill-6>

APPENDIX A – ORGANIZATIONS & RESOURCES FOR NATURAL INFRASTRUCTURE

Below is a list of organizations and resources that were identified throughout the workshop and evening event as being potentially useful for natural infrastructure in Alberta.

Government/ Public Sector

- Alberta Infrastructure
- Alberta Environment and Parks
 - Environmentally Significant Areas Report
<https://www.albertaparks.ca/albertaparksca/library/environmentally-significant-areas-report/>
 - Water Management Plans / Allocations / Guidelines
 - Management Plans https://www.alberta.ca/water-management-plans.aspx?utm_source=redirector
 - Allocations and Transfers https://www.alberta.ca/water-allocations-and-transfers.aspx?utm_source=redirector
 - Water Quality Guidelines https://www.alberta.ca/water-quality-guidelines.aspx?utm_source=redirector
 - Wetland Inventory Guidelines
 - Alberta Environment and Parks: Wetland Policy, Guidelines, and Directives <https://www.alberta.ca/alberta-wetland-policy-implementation.aspx>
 - Alberta Wetland Rapid Evaluation Tool (ABWRET) <https://open.alberta.ca/publications/9781460123652>
- Alberta Agriculture and Forestry
- Alberta Energy Regulators (water licences)
- Alberta Municipal Affairs
 - Big City Charter/Municipal Government Act—“environment” was mentioned for the first time
- Alberta Innovates
 - Ecosystem Services Leadership & Innovation Program (training program)
- Ag. extension specialists (provincial and municipal)
- Agriculture and Agri-food Canada (AAFC)
- Calgary Board of Education (naturalized areas for curriculum learning; stormwater management; biodiversity)
- City of Calgary (strategy; leadership; experts)
 - Resilient Calgary Strategy www.calgary.ca/resilientcalgary
 - Calgary’s Climate Program www.calgary.ca/climateprogram
 - source water protection plans <https://www.calgary.ca/UEP/Water/Pages/Watersheds-and-rivers/Souce-Water-Protection.aspx>
 - Biodiversity Strategic Plan www.calgary.ca/biodiversity
 - Riparian Action Plan <https://www.calgary.ca/UEP/Water/Documents/Water-Documents/Riparian-Action-Program-Report.pdf>
- City of Edmonton (charters; leadership; experts)

- Breathe (a strategy to sure that as the city grows, each neighborhood will be supported by a network of open spaces for the next 30 years)
 - https://www.edmonton.ca/city_government/initiatives_innovation/breathe.aspx
- Urban Primary Land and Vegetation Inventory (uPLVI) (natural asset management)
 - <https://data.edmonton.ca/stories/s/What-is-the-uPLVI-/jbuz-8rgn/>
- City of Vancouver
 - Rain City Strategy <https://vancouver.ca/files/cov/rain-city-engagement-boards-20180308.pdf>
- Infrastructure Canada
 - Disaster Mitigation and Adaptation Fund <https://www.infrastructure.gc.ca/dmaf-faac/dmaf-guide-faac-eng.html>
- InnoTech Alberta & ALUS (economic analysis and guidance documents; rural-urban interactions; watershed approach)
 - Municipal Natural Infrastructure Project (*see Appendix D*)
- Irrigation Districts (water use and management)
- National Research Council (NRC) currently reviewing and evaluating various drainage valuations with green-gray evaluation
- Public Sector Accounting Board (PSAB)
- Utilities
- University of Guelph
 - IMWEBs model to map natural infrastructure in Modeste subwatershed for downstream benefits (from wetlands, riparian areas)
- University (partnerships/ leverage) NSERC funding and POVs

Non-Profit / NGOs

- Alberta Low Impact Development Partnership (ALIDP) <http://www.alidp.org/>
- Alternate Land Use Services (ALUS) Canada <https://alus.ca/>
 - payments to farmers for BMPS
- Alberta Biodiversity Monitoring Institute (ABMI) <https://www.abmi.ca/home/about-us/governance-funding.html#>
 - Ecosystem Services Assessment (ESA) <https://ecosystemservices.abmi.ca/about-us/about-ecosystem-services/>
- Alberta Conservation Association (ACA) <https://www.ab-conservation.com/about/roles-and-responsibilities/>
- Alberta Real Estate Association <https://www.albertarealtor.ca/>
- Alberta Real Estate Foundation <http://aref.ab.ca>
 - Links water quality to the housing market
- Alberta Water Council (AWC) <https://www.awchome.ca/>
- Alberta WaterSMART <https://watersmartsolutions.ca/our-team/>
 - Team of engineers, environmental scientists and policy advisors for water management
- Alberta Urban Municipalities Association (AUMA) <https://auma.ca/about-us>
 - Work with elected officials and admin leaders to advocate for solutions to municipal issues (economic; environment; governance; infrastructure; social)
 - Asset management training
- Alberta crop sector working groups
- Alberta Narratives <https://albertanarrativesproject.ca>

- a community-based initiative to approach public engagement that aims to improvement communications on topic such as energy and climate.
Report I: “Communicating Climate Change and Energy in Alberta”
<http://albertanarrativesproject.ca/wp-content/uploads/2019/02/ANP-Report-I-Final-Online.pdf>
- Report II: “Communicating Climate Change and Energy with Different Audiences in Alberta”
<http://albertanarrativesproject.ca/wp-content/uploads/2019/02/ANP-Report-II-final-online.pdf>
- BILD Calgary Region <https://bildcr.com/about-us/>
- Calgary Metropolitan Region Board (CMRB) <https://www.calgarymetroregion.ca/>
 - Driving land use planning and working on watershed management
- Credit Valley Conservation (CVC)
 - Risk and Return on Investment Tool (RROIT)
<https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/rroit/>
- Convention on Biological Diversity (Canadians Study Taskforce)
 - Ecosystem Services Toolkit https://biodivcanada.chm-cbd.net/sites/biodivcanada/files/inline-files/2017_Ecosystem_Services_Toolkit.pdf
- Cows and Fish
 - Provide advise on BMPs <http://cowsandfish.org/about/about.html>
- Ecosystem Services and Biodiversity Network (ESBN) <https://ecoservicesnetwork.ca/about/>
 - Multidisciplinary group of stakeholders working on ecosystem services
- Edmonton Metropolitan Region Board (ERMB) <http://emrb.ca/>
- Federation of Canadian Municipalities (FCM) <https://fcm.ca/en>
 - Green Municipal Fund <https://fcm.ca/en/programs/green-municipal-fund>
 - Municipal Asset Management Program (grant funding)
<https://fcm.ca/en/programs/municipal-asset-management-program>
- Forest Research Improvement Association (FRIA) <https://friaa.ab.ca/>
- Foothills Institute <https://friresearch.ca/content/who-we-are>
- First National Technical Services Advisory Group (TSAG)
 - train First Nations in Alberta Asset Management such as water and waste water management, environmental management etc. <http://www.tsag.net/>
- Infrastructure Asset Management Alberta (IAMA) <http://assetmanagementab.ca/>
 - Working groups members from various municipalities and hold workshops
<http://assetmanagementab.ca/workinggroup/>
- Intact Centre on Climate Adaptation (Intact Centre), in partnership with University of Waterloo
<https://www.intactcentrecclimateadaptation.ca>
 - Helps to identify and reduce risks associated with climate change and extreme weather events
- Insurance Bureau of Canada
 - Flood Costs and Natural Infrastructure. “*Combatting Canada’s Rising Flood Costs.*”
<http://www.ibc.ca/ns/resources/studies/natural-infrastructure-is-an-underutilized-option>
- Miistakis Institute <https://www.rockies.ca/>
 - Works with municipalities on environmental and conservation issues
- North Saskatchewan Watershed Alliance (NSWA)

- Riparian intactness study (currently in 3 watersheds and expanding to 5 more).
“Modeste Watershed Riparian Area Assessment.” https://www.nswa.ab.ca/wp-content/uploads/2018/04/Modeste-Riparian-Assessment-2018_-Fiera.pdf
- Prairie Conservation Forum <http://www.albertapcf.org/>
- Rural Municipalities of Alberta (RMA) <https://rmalberta.com/>
 - Rural municipal advocate; research and share best practices; operate as an innovative, responsive, and learning organization)
 - Asset Management Workshops for Elected Officials and Municipal Staff
<https://rmalberta.com/events-programs/asset-management-workshops-for-elected-officials-and-municipal-staff/>
- Urban Development Institute (UDI) Edmonton <https://www.udiedmonton.com/>
- Watershed Planning and Advisory Councils (WPACs) <https://www.alberta.ca/watershed-planning-and-advisory-councils.aspx>

Private Sector

- Associated Engineering (has worked with outflows and water treatment plans on municipal and indigenous lands <https://www.ae.ca/>)
- Altalis
 - LiDAR data for a fee Altalis <https://www.altalis.com/>
- Canadian GIS (LiDAR data collection)
 - Free and open LiDAR data sources in Canada <https://canadiangis.com/free-canada-lidar-data.php>
- Landowners
- Municipal Natural Asset Initiative (MNAI) <https://mnai.ca/>
 - *Primer on Natural Asset Management* (a good document to use to convince Council to consider natural assets) https://mnai.ca/media/2018/01/FCMPrimer_Jan1_2018.pdf
 - *Towards a Collaborative Strategy for Municipal Natural Asset Management: Private Lands* <https://institute.smartprosperity.ca/sites/default/files/reportmnaifeb7.pdf>
 - *Towards an Eco-Asset Strategy in the Town of Gibsons*
https://mnai.ca/media/2018/01/EcoAsset_Strategy.pdf
 - *Advancing Municipal Natural Asset Management: The Town of Gibsons experience in financial planning & reporting*
<https://mnai.ca/media/2018/01/GibsonsFinancialPlanningReport-WEB.pdf>
 - Case Studies https://mnai.ca/media/2018/01/TownofGibsons_CaseStudy.pdf
 - *Advancing Municipal Natural Asset Management Through Infrastructure Funding Opportunities* https://mnai.ca/media/2019/07/SP_MNAI_Report5_June2019.pdf
 - *Advancing Municipal Natural Asset Management Through Professional Planning: Twelve Action Steps* https://mnai.ca/media/2019/07/SP_MNAI_Report4_June2019.pdf
 - *Advancing Municipal Natural Asset Management Through Collaborative Strategies for Private Lands* https://mnai.ca/media/2019/07/SP_MNAI_Report3_June2019.pdf
 - *Advancing Municipal Natural Asset Management Through Financial Planning and Reporting: Learning from the Town of Gibsons’ Experience*
https://mnai.ca/media/2019/07/SP_MNAI_Report2_June2019.pdf
 - *What are the Municipal Natural Assets: Defining and Scoping Municipal Natural Assets Decisions-Maker Summary* https://mnai.ca/media/2019/07/SP_MNAI_Report-1-June2019-2.pdf

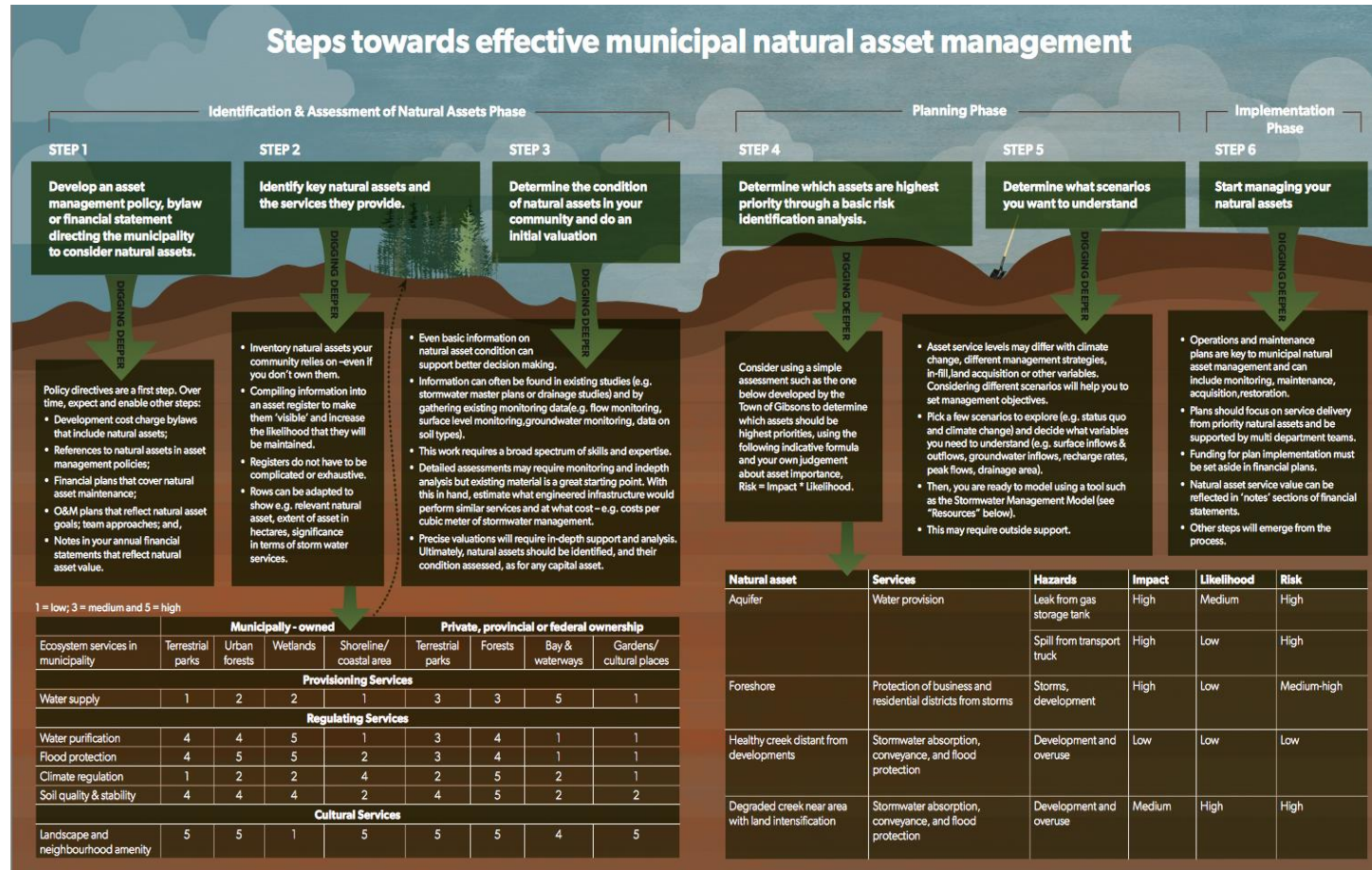
- Urban Systems <https://urbansystems.ca/about-us/>
 - Works with municipalities on implementing natural infrastructure projects
- Tetra Tech (engineering firm) work on the NSR <http://www.tetrattech.com/en/about>

Researchers/Other

- Engineers & Geoscientists British Columbia <https://www.egbc.ca/>
 - May provide an official guidance document in the future on natural infrastructure for professional designations such as engineering, forestry etc.
- Forestry and agroforestry research groups
- Irene Creed, Executive Director and Professor, School of Environment and Sustainability from University of Saskatchewan
 - Research on hydrology, wetlands, and ecosystem services
<https://sens.usask.ca/people/faculty/core-faculty/creed-irena.php#AcademicCredentials>
- Regional limnologist and hydrologist
- Traditional Ecological Knowledge Policy (TEK)
- Vic Adamowicz, Vice Dean and Professor, Agricultural Life and Environmental Sciences (REES) from University of Alberta
 - Research on ecosystem services and economics

Municipal Natural Assets Initiative

The MNAI provides a list of recommended steps to be taken to effectively manage natural assets. The steps are broken down into phases: (1) Identification & Assessment; (2) Planning; (3) Implementation. Source: https://mnai.ca/media/2018/01/FCMPrimer_Jan1_2018.pdf



APPENDIX B – ORGANIZATIONS IN ATTENDANCE

First Name	Last Name	Title
Achyut	Adhikari	Ecological Planner, Urban Growth and Open Space Strategy, EDMONTON
Alice	Yu	Business Strategist, Climate, CALGARY
Amanda	Legros	Planner, COCHRANE
Amy	Zaluski	Climate Change Specialist, ROCKYVIEW
Andre	Asselin	Executive Director, ALBERTA WATER COUNCIL
Andre	Ulloa	Asset Manager Coordinator, CHESTERMERE
Andrew	Sommerville	Parks Infrastructure Coordinator, LETHBRIDGE
AnnLisa	Jensen	Councillor, PARKLAND COUNTY
Bert	van Duin	Drainage Technical Lead, CALGARY
Bhupesh	Sakalley	Asset Manager, BRAZEAU COUNTY
Blair	Richter	Asset Manager, LETHBRIDGE
Blair	Kreiner	IPM Technician, AIRDRIE
Brandi	Dechkoff	Asset Management Coordinator, PARKLAND COUNTY
Brit	Samborsky	Leader, Climate, CALGARY
Bryce	Surina	Director of IT & GIS, TABER
Carol	Stefan	Parks Ecologist, CALGARY
Carolyn	Bowen	Manager, Watershed Planning, CALGARY
Catherine	Shier	Ecological Planner, EDMONTON
Chetan	Sainath	Capital Accountant, CALGARY
Christina	Hopkins	Asset Management Specialist, URBAN SYSTEMS
Christine	Campbell	Hub Manager (West), ALUS CANADA
Clint	Goodman	Corporate Environmental Coordinator, AIRDRIE
Corey	Colbran	Climate Change Specialist, CALGARY
Courtney	Teliske	Urban Forester Natural Areas Operations, EDMONTON
Craig	Pittman	Director of Infrastructure, TABER
Danielle	Koleyak	Environmental Project Manager, EDMONTON
Darren	Lockhart	Manager, Application Services, Calgary Approvals Coordination, CALGARY
Dave	Dittrick	Assistant County Manager, RED DEER COUNTY
David	Down	Chief Urban Designer, CALGARY
David	Purcell-Chung	Leader, Planning & Development Services, CALGARY
David	Ellis	Parks Manager, LETHBRIDGE
Dawn	Smith	Environment & Sustainability Manager, OKOTOKS
Diana	Staley	Economic Researcher, INNOTECH ALBERTA
Don	Sun	Operations Strategist, Parks, CALGARY
Erin	Belva	Supervisor of Infrastructure Operations Planning, EDMONTON

Glen	Thoman	Consultant Member, UDI--EDMONTON REGION
Gracelyn	Shannon	Asset Management Coordinator, GIBSONS, BC
Guy	Greenaway	Senior Project Manager, MIISTAKIS INSTITUTE
Harpreet	Sandhu	Team Lead, Water Resources, CALGARY
Heather	Galbraith	Program Lead, Resilience & Infrastructure Calgary, CALGARY
Isabel	Gordon	Director of Financial Services, WEST VANCOUVER
Jamie	Rozema-Stinson	Business Asset Strategies Lead, Parks, CALGARY
Jen	Pouliotte	Senior Planning & Policy Strategist, CALGARY
Jill	Curley	Corporate Environmental Specialist, Climate, CALGARY
Jodi	Collins	General Clerk, COCHRANE
John	Do	Financial Reporting Lead, Accounting Research, CALGARY
Julie	Guimond	Urban Forestry Lead, CALGARY
Kaitlin	Chantler	Corporate Environmental Specialist, CALGARY
Karim	Pabani	Lead, Infrastructure Calgary, CALGARY
Ken	Lewis	Conservation Coordinator, RED DEER COUNTY
Leah	Kongsrude	Executive Director, NORTH SASKATCHEWAN WATERSHED ALLIANCE (NSWA)
Lorin	McConnell	Leader, Corporate Asset Management, CALGARY
Maggie	Nelson	Public Program Coordinator, Water Resources, CALGARY
Maggie	Choi	Manager, Infrastructure Planning, Water Resources, CALGARY
Marian	Weber	Principal Researcher, INNOTECH ALBERTA
Mary	Quinlan	Development Coordinator, Calgary Recreation, Capital Development, CALGARY
Mary Ellen	Shain	Watershed Planning and Management Coordinator, NORTH SASKATCHEWAN WATERSHED ALLIANCE (NSWA)
Melina	Scholefield	Manager, Green Infrastructure Implementation, VANCOUVER
Michelle	Molnar	Technical Director, MUNICIPAL NATURAL ASSETS INITIATIVE (MNAI)
Mike	Mahon	Urban Forestry Superintendent, CALGARY
Oyinola	Shyllon	Economist and Regulatory Lead, CALGARY
Pamela	Duncan	Watershed Engineer, CALGARY
Quincy	Brown	Senior Watershed Planner, CALGARY
Rhonda	King	Lead for Regional Development (West), ALUS CANADA
Roy	Brooke	Executive Director, MUNICIPAL NATURAL ASSETS INITIATIVE (MNAI)
Ryan	O'Grady	Director of Engineering Services, COURTENAY, BC
Sheri	Young	Climate Change Energy Specialist, OKOTOKS
Tatiana	Koveshnikova	Senior Coordinator, Ecosystem Goods and Services, CREDIT VALLEY CONSERVATION
Todd	Rathie	Financial Reporting Officer, CALGARY
Wendy	Cotton	Provincial Policy Specialist - Alberta, DUCKS UNLIMITED CANADA

**Advancing Municipal Natural Infrastructure
Management in Alberta
Workshop**

September 19 - 20, 2019

Calgary

Water Centre

625 – 25 Avenue SE, Calgary

(Bow River Meeting Room)

Natural infrastructure and the services they provide are a fundamental part of municipal infrastructure. A growing number of local governments are incorporating natural infrastructure into core decision-making and asset management processes. The evidence to date shows this can save money, reduce risk and result in cost-effective and reliable service delivery.

Best practices and gaps are emerging as municipalities learn more about how to assess and incorporate natural infrastructure in planning and asset management decisions. In Alberta, there is an opportunity for communities to learn from these experiences, relate them to local contexts, and develop a roadmap towards strong and consistent approaches to municipal natural infrastructure management that can easily be adopted across the province.

Goal

The workshop goal is to equip Alberta local governments with an understanding of the emerging evidence on municipal natural infrastructure management and develop a roadmap to expand the practice in Alberta based on local context.

This will be achieved by bringing together local governments and experts to share experiences and best practices and co-develop a roadmap to embed natural infrastructure considerations in all aspects of core municipal decision-making.

AGENDA | day one

WHY NATURAL INFRASTRUCTURE SHOULD BE CONSIDERED IN MUNICIPAL DECISION MAKING

- 12:30 PM - 1:00 PM **Refreshments and Networking**
- 1:00 PM - 1:15 PM **Welcome and Introductions**, Calgary and InnoTech Alberta
- 1:15 PM - 2:00 PM **Setting the Stage**, *Roy Brooke (facilitator)* Municipal Natural Assets Initiative (MNAI)

Municipal Natural Infrastructure Experiences in Canada

- 2:00 PM - 4:00 PM **Gracelyn Shannon** (Gibsons, BC)
Share Gibsons, BC experience as one of the first municipalities to integrate natural infrastructure into municipal planning. Topics include: what they have done and why; asset management policy; development cost charges; compare engineering to natural assets; and a business case.
- Tatiana Koveshnikova**, Credit River Watershed in Ontario (*via weblink*)
Provide details on original natural asset management project and how it has scaled up across the Credit Valley Watershed
- Isabel Gordon** (West Vancouver, BC)
Provide an overview of what and why West Vancouver has incorporated natural infrastructure and the business case and financial drivers
- Melina Scholefield** (Vancouver, BC)
Provide an overview of the *Rain City Strategy* and how disparate parts of green infrastructure have been stitched together in one cohesive plan.
- Ryan O’Grady** (Courtenay, BC)
Provide an overview of an emerging watershed project with an engineering viewpoint on asset management
- Michelle Molnar**, MNAI Technical Advisor
Provide an overview of the asset management approach and methodology for natural infrastructure, lessons learned and top technical issues
- Roy Brooke** (facilitator)- *lead 45 minutes discussion with audience*
Discuss: a) questions, clarifications, issues; and b) begin clustering disciplinary or asset management challenges, gaps, issues

Taking Stock in Alberta

4:00 PM- 5:00 PM

Facilitated Discussion with Participants

Municipalities will be asked to speak to questions provided in advance. Questions relate to natural infrastructure motivations; issues/challenges; current status; future plans. Who is doing what in Alberta and gaps and drivers will be identified.

Infrastructure Asset Management Alberta (IAMA)

Speak to how they currently consider natural assets

5:00 PM - 5:15 PM

Summary of the Day

A summary of the discussion on Day 1 as well description of what will be discussed on Day 2.

Adjourn

***NOTE AN EVENING EVENT HOSTED BY THE CITY OF CALGARY WILL BE HELD AT:**

City Building Design Lab (Former Central Library)

616 Macleod Trail SE

@ 6:30 PM – 8:30 PM

(appetizers and cash bar provided)

AGENDA | day two

HOW NATURAL INFRASTRUCTURE SHOULD BE CONSIDERED IN MUNICIPAL DECISION MAKING

9:00 AM - 9:15 AM **Welcome**, Brad Stevens, Chief Resilience Officer & Deputy City Manager, Calgary
Recap, Roy Brooke

Spotlight on Financial Planning and Reporting

9:15 AM - 11:15 AM **Roy Brooke**
Provide a brief introduction to contextualize financial reporting and planning as a subset of natural asset management issues and provide PSAB comments.

Isabel Gordon (West Vancouver, BC)

Introduce personal story as a CPA with natural infrastructure and provide information on the benefits and issues with natural infrastructure through asset management and some reflection on PSAB process. Lead a subsequent panel discussion.

Gracelyn Shannon (Gibsons, BC)

Explain what Gibsons has done and to elaborate on their Financial Planning and Reporting document.

Michelle Molnar, MNAI Technical Advisor

Describe her view as an environmental economist as well as experiences with local governments, federal AG experience, and upcoming CPA conference.

Group Discussion and Q&A

Mapping the Journey

11:15 AM-1:30 PM **Discussion Sessions with Group Leaders**
Participants will work in discussion groups to develop & prioritize actions that are needed to advance municipal natural infrastructure. Rapporteurs will be available to assist in keeping notes for each discussion group.

[concurrent]

12:00 PM-1:00 PM **LUNCH**
(provided during group discussion sessions)

1:30 PM–2:30 PM **Plenary Session**
Group Leads report back on the questions discussed. Facilitator will record common themes and issue.

2:30 PM–3:00 PM

Wrap-up and Next Steps

Group Leads report back on the questions discussed. Facilitator will record common themes and issue.

***NOTE GREEN ALLEY PROJECT LAUNCH @ 5:00pm**

This is a voluntary event after the workshop and is being held by Art and the City and the Calgary Downtown Association.

More information can be found at:

https://events.ucalgary.ca/sapl/#!/view/event/event_id/5574

APPENDIX D – POWERPOINT SUMMARIES AND SLIDES

1.9 LIST OF PRESENTATIONS

Below is a table with a list of the presentations. Note the video can be viewed on The City of Calgary’s website: <https://mycity.wistia.com/projects/ivpu7z06qm>

Table 1: List of Presentations

Roy Brooke Municipal Natural Assets Initiative	<i>The case for natural asset management</i>
Isabel Gordon District of West Vancouver	<i>Natural Capital Assets District of West Vancouver</i>
Melina Scholefield City of Vancouver	<i>Rain City Strategy: A green rainwater Infrastructure initiative</i>
Tatiana Koveshnikova <i>Credit Valley Conservation</i>	<i>CVC-led Municipal Natural Asset Projects: Experience Up to Date</i>
Michelle Molnar Municipal Natural Assets Initiative	<i>Advancing Municipal Natural Infrastructure Management in Alberta; MNAI AM Approach and Methodology for natural assets</i>
Michelle Molnar Municipal Natural Assets Initiative	<i>Advancing Municipal Natural Infrastructure Management in Alberta; Spotlight on Financial Planning and Reporting</i>
Gracelyn Shannon Town of Gibsons, BC	(no PowerPoint presented)
Ryan O’Grady Town of Courtney, BC	(no PowerPoint presented)

1.9.1 Summary of Roy Brooke Presentation

Day 1 is mostly about the “what?” of asset management and hearing from local governments in Alberta regarding their challenges, barriers, etc.; Day 2 is more about the “how?” and spotlighting the finance aspect of asset management, and a facilitated session to develop a commonly agreed upon roadmap that will help municipalities move forward. Taking the interest in this room, overcome barriers, create a roadmap, and hopefully in a year, more people will have interesting work being implemented.

Background story: The CAO of a small BC town was having a strategy session with their Council, and determined that drinking water, emergency services, and sewage are the three most important services they provide. They realized that two of their most important services come from a natural asset.

“Wonderful! We don’t have to pay for it!” But this led to questions and uncomfortable answers; *What do we know about the aquifer? How are we protecting it? If this asset provides two of our three most vital services, then what are we doing about it?* Zero dollars were being spent on maintenance and management of this asset. Little knowledge was housed in the organization about those natural assets as well. Drilling into individual responsibilities – no consideration was being made for how decisions might affect this aquifer. In terms of costs, there was a vague sense that the aquifer was irreplaceable, and capital costs to replace this aquifer would get tangled up in the community for years. They realized they needed to start thinking differently about how they could protect and value this natural asset.

Key message: Natural assets can deliver core local government services that they would otherwise need to deliver by engineered assets.

A definition of natural infrastructure was suggested so that the participants can understand for the purpose of the workshop discussions. There are three “buckets”: 1) Natural Assets (wetland, lakes, fields, rivers, etc.); 2) Enhanced Assets (roofs draining into engineered wetlands, swales, channels, etc.); and 3) Engineered Assets (low impact development – rain gardens, permeable pavers, etc.).

Almost all local governments rely on natural infrastructure, but do not recognize/acknowledge the services they offer; local governments think about natural infrastructure fairly narrowly in terms of social, cultural amenities but in the absence of understanding the deeper dependencies, there is a potential risk and liability – what it will cost to be replaced.

Based on a Federation of Canadian Municipalities (FCM) analysis, about 1/3 of Canadian infrastructure range from average, poor or very poor conditions now. We need new sustainable service delivery solutions – which could be stitching ecosystem services and asset management together. Across Canada, our infrastructure is ageing, and local government is responsible for maintaining it. For example, 164 million m³ of sewage spilled out from sewage overflows in 2017, suggesting that whatever (pipes) is in the ground is not available to handle what we are experiencing.

Speaking of the cost, federal disaster payouts are \$600 million (double what it was 40 years ago, mostly from water/flood related incidents). No immediate savior exists – local governments are squeezed financially, and the obvious problem of climate change exists.

If we have natural assets on which we pay no capital costs, and which provide a vital service, then we need to treat them like gold and move them into a central position as we are thinking about how to deal with challenging problems such as aging infrastructure, financial constraints, changing climate, etc. Local governments need to start developing modern structured asset management. MNAI is finding increasingly that natural infrastructure can basically be considered as part of the same asset management that we have to do anyway, just another asset. We don't need to care if it's a wetland or a culvert, what we care about is if the service that it provides is reliable and effective.

Gibsons, BC was the first mover in 2013. There is a small but compelling group of local governments in Canada that can be translated and applied in Alberta. We have a good platform in the form of asset management. The enabling environment around us is evolving quite quickly; the Federal government has a number of different funding programs that were non-existent a couple years ago. They are making strides toward recognizing natural infrastructure as formal infrastructure. For example, Grand Forks, BC has received \$49 million from the Disaster Mitigation and Adaptation Fund (DMAF) to do a managed retreat from the river and restore adjacent wetlands rather than constructing berms and dams.

Under the Public Sector Accounting Board (PSAB) you cannot consider natural infrastructure to be a tangible capital asset. This is undergoing a major review and there is interest to change the PSAB definitions and reporting guidelines to include natural assets.

MNAI has done work to ask "*What does natural infrastructure mean for Planners?*". They received funding from the Real Estate Foundation of BC to do the work they would need to have as a practice guideline (the normative piece) on asset management which would include natural asset management.

Insurance Bureau of Canada and the Intact Centre has documented the insured losses from flooding risks (which are enormous and growing), and one of their statements is around natural infrastructure; the basic point is to preserve what you can and build only what you must. Protect the natural infrastructure first. This is an important signal from the insurance world.

A municipality will find it difficult to deliver reliable and cost-effective services unless it has healthy natural ecosystems. This brings with it an enormous stream of co-benefits, and can range from biodiversity issues, species at risks, etc. Even though we are talking about it narrowly from the point of view of local government services, there are a number of core benefits involved.

Another interesting feature of natural infrastructure is that they are resilient and adaptable. Work in Ontario and elsewhere found that natural infrastructure increases its value over time; modelling suggests they become more valuable over time because they are resilient to the circumstances around them (e.g. a pipe cannot grow or bend or change).

The case for natural asset management

Roy BROOKE
September 19 2019



Natural assets can deliver core local government services

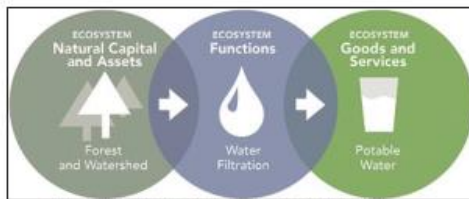


Figure 1: Natural Capital creates Ecosystem Goods and Services
(Image source: Earth Economics <http://www.earthconomics.org/science-economics/>)



Definitions



Natural assets are often underrecognized and overused



We need new service delivery solutions



Canadian Press 2019



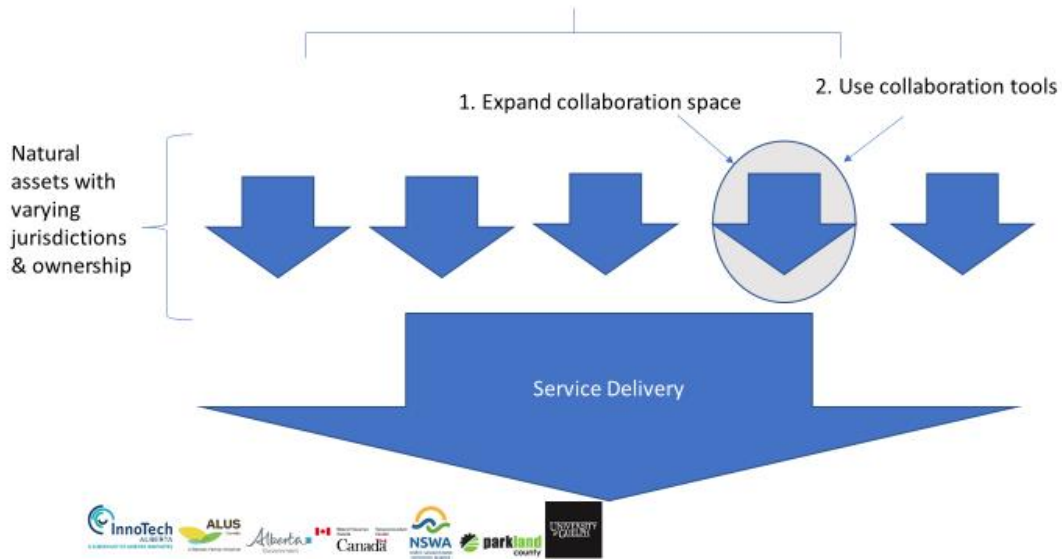
Asset management is a valuable tool for managing natural assets



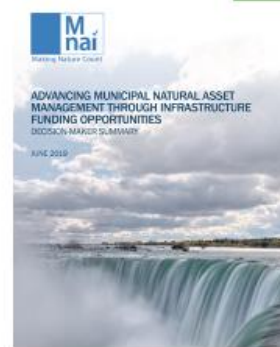
Source: Adapted from Asset Management BC, 2014.



Governance, Jurisdiction & Ownership



Evidence base & activity are growing



Co-benefits and features of natural assets



1.9.2 *Summary of Isabel Gordon Presentation*

Isabel Gordon, Director of Financial Services, West Vancouver, British Columbia

DAY 1

West Vancouver realized that the municipality had a significant amount of information on natural infrastructure; the information just was not collected that way and they subsequently needed to organize the information and begin to place value on it. Their first step was to organize all the staff in the organization that worked with natural assets and pull out the information that was needed; this step was very beneficial in getting the municipality started.

West Vancouver worked with the region and others in their organization to bring together multiple sources of natural infrastructure information into one complete inventory. They determined the area (hectares), location, who is involved with the assets and determined a service value based primarily on (avoided costs) x (area). For West Vancouver, the value of their natural infrastructure was \$3.8 billion. They used different approaches for valuation depending on the asset and ability to replace it, and the methods were reviewed externally to add credibility (e.g. avoided costs, etc.). Drivers included recognizing the role of natural assets in stormwater management compared to grey assets and the increasing reluctance for the insurance industry to insure the foreshore due to risk. They are now starting to understand that parks provide not only recreation but other ecosystem services. Council has received this with enthusiasm however implementation is a challenge when it involves private property. They are now working to understand other attributes of assets – how they function, what the risks are to them, how to best manage them. With the support of the City Auditor, they are adding a note to financial statements and natural capital ledger with 20-year projections of maintenance requirements so that they can be funded just like other assets. The intent is to include them in future decision making, monitor and update values so that ecosystems are not degraded further.

DAY 2

In this presentation, Isabel suggests that natural assets need to be part of the beginning of the decision-making process when it is determined where scarce resources should be allocated. To do this, we need to involve our finance departments and begin to value our natural assets from a broader framework.

Valuation includes thinking of the stream of services and how well they contribute to service delivery. In terms of what services, she suggests that municipalities are now expanding their understanding and are including previously excluded services such as carbon sequestration. Cities cannot rely on other levels of government as they are tied to geography of the land and risks associated with that. In this context, the value of natural assets is quite high. In order to pay for natural assets, West Vancouver is looking at adding levies for natural assets in their development control bylaws.

PowerPoint Presentation by Isabel Gordon

Natural Capital Assets District of West Vancouver

Isabel Gordon, MBA, CPA, CA
Director, Financial Services
District of West Vancouver



West Vancouver, British Columbia

Natural assets define
our community



We have an abundance of trails
and easy access to nature

135 KM
of trails
and more expected to come

Our community enjoys a
remarkable supply of parkland

220+
hectares of parkland



NATURAL CAPITAL IN WEST VANCOUVER

District of West Vancouver

Incorporating Natural Capital into Decision-making

- How can we do this?
- Why would we do it?

Financial Implications

- Cost of alternatives
- Maintenance and replacement
- Resiliency

Regulatory Implications

- Professional standards
- Path dependency

NATURAL CAPITAL IN WEST VANCOUVER

MNAI-West Vancouver Pilot Project Daylighting Westcot Creek

Project Outcomes

- ❖ A holistic understanding of the potential value of daylighting the covered portion of the stream compared to asset replacement with the use of a pipe
- ❖ Management options for the District to apply to Brothers Creek and other streams that can be daylighted to maximize benefits
- ❖ Broadening local government's understanding of how to place a value on reclaimed natural assets and to account for this within current financial and asset management processes
- ❖ A model that can be applied elsewhere in the District to estimate the financial value of daylighting streams
- ❖ An operations and maintenance plan for the stream
- ❖ Local public/student engagement in the process of daylighting and awareness of the value of natural assets



NATURAL CAPITAL IN WEST VANCOUVER

Natural Capital Inventory: Project Objectives

Create an initial, high level inventory of natural capital to:

- inform decision-making inside and outside organization
- Move natural assets to the centre of the process
- start a conversation: raise public awareness



NATURAL CAPITAL IN WEST VANCOUVER

Natural Capital Inventory: Making it credible

- ❖ involve diverse staff team with understanding of the main asset classes
- ❖ use previously published work
- ❖ submit to external advisory panel for credibility
- ❖ make it engaging and easy to read
- ❖ anticipate challenges

NATURAL CAPITAL IN WEST VANCOUVER

Natural asset classes



Forests – subdivide Upper and Urban forests



Waterways – lakes, ponds, river, creeks, streams, and ditches



Foreshore – beach and rocky foreshore



Parks and open space – grassland and shrubs

NATURAL CAPITAL IN WEST VANCOUVER

Valuation methods - overview

- ▶ Basic formula is area x annual service value
(ecosystem hectares x \$ value of services per hectare for that ecosystem type)
- ▶ Area in hectares comes from District GIS department using in house image capture and Metro Vancouver database
- ▶ Ecosystem service values obtained from valuations of natural capital in Howe Sound and Lower Mainland

NATURAL CAPITAL IN WEST VANCOUVER

Valuation methods



- avoided cost
- contingent valuation
- hedonic pricing
- opportunity cost
- travel cost
- replacement cost
- production

NATURAL CAPITAL IN WEST VANCOUVER

Forests



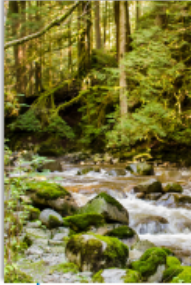
Valuation driven mainly by role in regulating and filtering water.

Key issues and implications:

- climate change
- managing competing uses
- sensitive development
- protecting trees on private land

NATURAL CAPITAL IN WEST VANCOUVER

Waterways



Valuation driven by clean water supply (reservoirs), and regulation of water flows (storm water management).

Key issues and implications:

- development
- riparian area management
- invasive species
- climate change

NATURAL CAPITAL IN WEST VANCOUVER

Foreshore



Valuation driven by erosion regulation and recreation.

Lack of studies for west coast ecosystem services.

Key issues and implications:

- foreshore encroachments
- climate change and sea level rise
- shoreline restoration

NATURAL CAPITAL IN WEST VANCOUVER

Parks and open space



Mostly qualitative as many parks and trails covered in Forest and Foreshore sections.

Includes grasslands in alpine areas, along rights of way, playing fields, school yards and private yards.

Focus on carbon storage in soils and recreation.

Key issues and implications:

- some key services, e.g. health, can't be valued yet
- increased demand and conflicts in use
- ecosystem degradation
- invasive plants

NATURAL CAPITAL IN WEST VANCOUVER

Valuation summary

Natural capital asset class	All monetary amounts in \$1,000s CDN (2019)			
	Low estimate annual service	High estimate annual service	Low estimate asset	High estimate asset
Upper forest	\$13,167	\$37,197	\$438,885	\$1,239,911
Urban forest	\$6,442	\$18,200	\$214,737	\$606,662
Total waterways (including riparian buffer)	\$2,644	\$17,218	\$88,128	\$573,935
Total foreshore	\$4,837	\$16,487	\$161,234	\$549,589
Total grasslands	\$487	\$487	\$16,237	\$16,237
Total carbon storage – forest, soils	n/a	n/a	\$228,842	\$228,842
Totals	\$27,577	\$89,589	\$1,148,063	\$3,215,176

NATURAL CAPITAL IN WEST VANCOUVER

Next steps



NATURAL CAPITAL IN WEST VANCOUVER

1.9.3 *Summary of Melina Scholefield Presentation*

Melina Scholefield, Manager, Green Infrastructure Implementation, City of Vancouver

Melina describes the Vancouver Rain City Strategy, a “reimagining” of how they are looking at water and natural systems using engineered and enhanced natural assets. This includes a thirty-year implementation plan to restore the natural water cycle and support objectives related to water quality, resilience and livability through healthy urban ecosystems. Drivers are housing affordability, climate change, vulnerability of assets, habitat loss & biodiversity and combined sewer overflow. A focus on cultural transformation was key. The project team worked with a cross section of staff from senior executives to operators by asking “who has a role in water management?” and understanding what matters to them. Governance includes a committee of 23 Directors from across the organization plus working groups, technical committees and support from Engineering, the Parks Board, Planning/Sustainability & Urban Design, Finance, Development & Building Licensing, as well as the City Manager as chief executive. The strategy was also informed an expert panel as well as information from jurisdictions including Chicago, Rock Creek, Washington DC, Portland OR, New York City and Philadelphia. The Rain City Strategy goes to Vancouver City Council on 2019 November 5 and includes nine transformational directions and three action plans for: Parks and Beaches; Buildings and Sites; and, Streets and Public Spaces. They have a commitment of \$70 million over four years for implementation.



RAIN CITY STRATEGY:

A green rainwater Infrastructure initiative

H:\GREEN INFRASTRUCTURE\13-8100-02 - Green Infrastructure - Reference Materials\Photos\Vancouver_GI\Bioretention bulges, plant sale, GI brochure\DSC09682.JPG

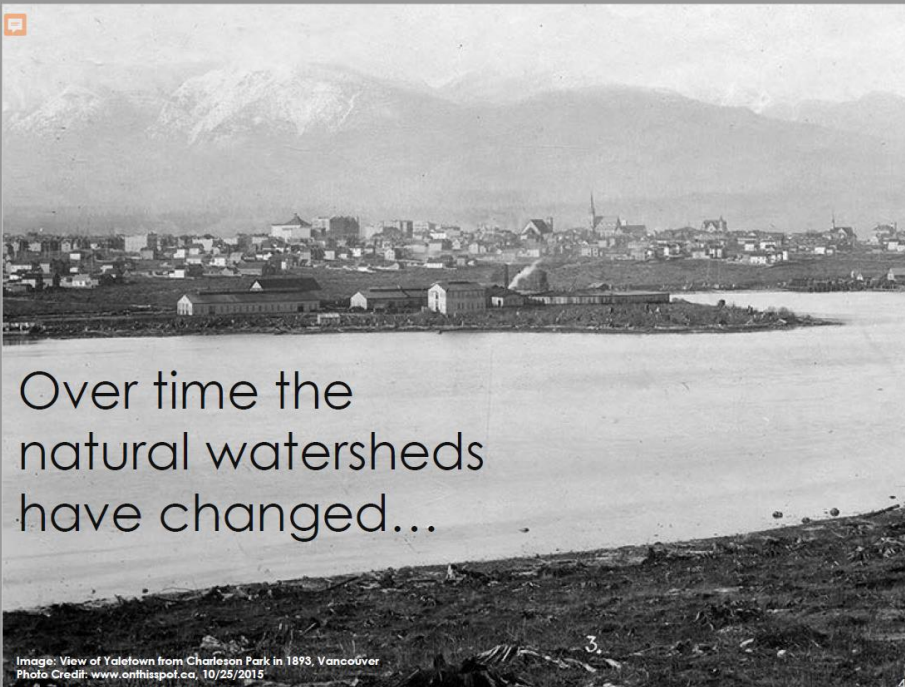
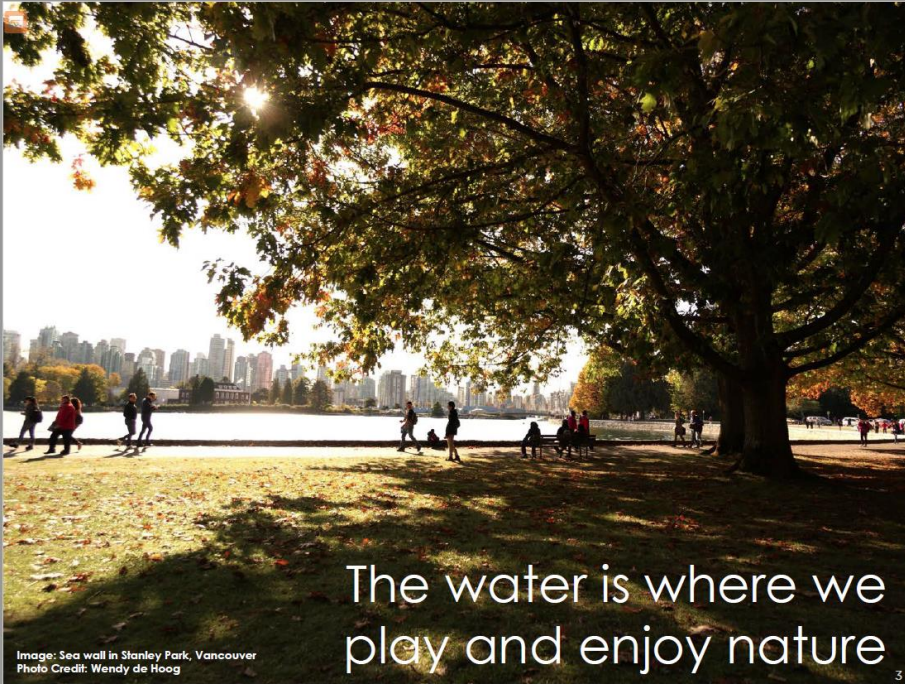
Melina Scholefield, P. Eng.
Manager, Green Infrastructure Implementation, City of Vancouver
Advancing Municipal Natural Infrastructure Management in Alberta |
September 19-20, 2019



Vancouver is a city surrounded by water

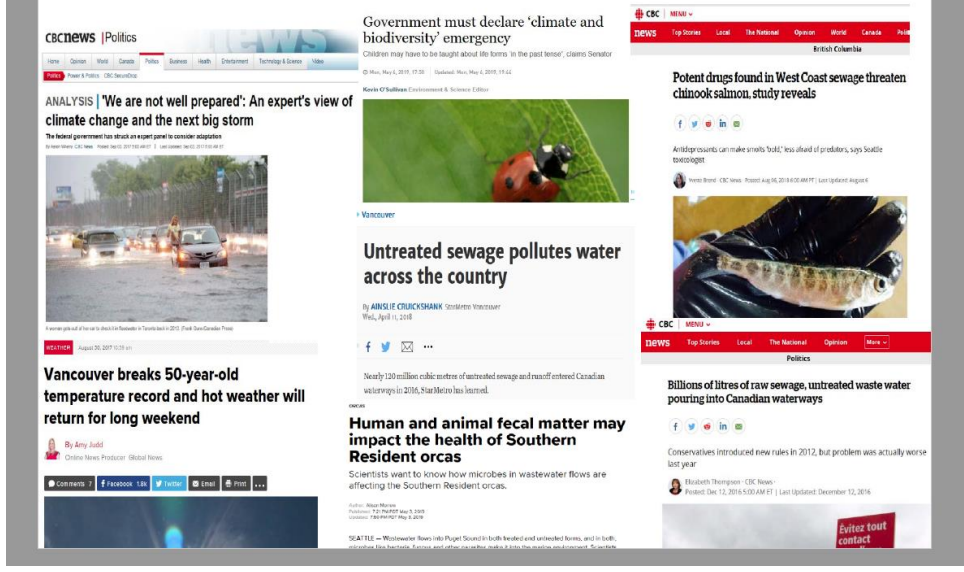
Image: Overview of Vancouver
Photo Credit: www.fiercebiotech.com 01/25/2017

2





HOT OFF THE PRESS... EVERY DAY, A NEW STORY ABOUT CLIMATE CHANGE IMPACTS & URBAN WATER POLLUTANTS



Models predict Decrease in snowpack in drinking watersheds



Image: Capilano lake, North Vancouver
Photo Credit: Wendy de Hoog

WARMER WINTERS

58%
decrease in
snowpack

WHICH MEANS

increased
risk of
summer
drought



minimum
temp goes
up by

4.8°



29%
reduction
in home
heating
needs



increased risk
of coastal
flooding



because of king tides
and stormy weather

9

Models predict Sea level rise of 1 meter by 2100 and 2 meters by 2200

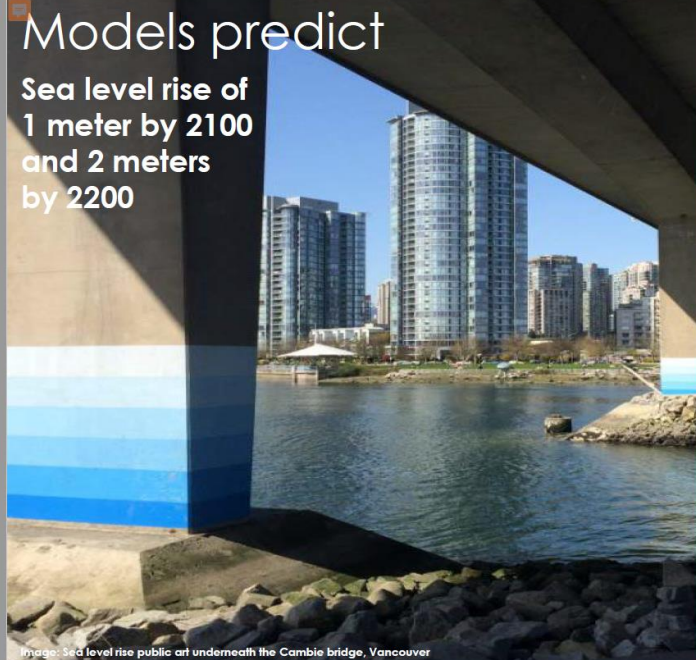
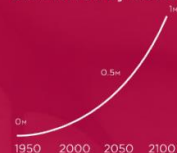


Image: Sea level rise public art underneath the Cambie bridge, Vancouver

HIGHER SEA LEVELS

Sea levels may rise
0.5 metres by 2050



Sea level rise
contributes to
increased
flood risk



Coastal habitat
for birds and
fish may shrink



10

Models predict More intense rain storms like on October 12, 2017



Image: Flooding of Cambie St & W Broadway, Vancouver
Photo Credit: Alexandra Couillard

WETTER AUTUMNS

heavy rain events
35% more intense



21% more rain on the wettest days



WHICH MEANS

a higher flood risk



Models predict More extreme heat



Image: Heat stress

WARMER SPRINGS

15% longer growing season



72% decrease in frost days



snow melts earlier



20% increase in April showers



HOTTER SUMMERS

more frequent heat waves



hottest days even hotter



43 twice as many days above 25°C

18

1980s 2050s

WHICH MEANS

increased health risks to vulnerable people



20% less rain



increased water restrictions



Green Rainwater Infrastructure

(enhanced natural assets)

Uses vegetation, soils and other engineered systems and practices to mimic natural processes required to manage water and create resilient and healthier urban environments



Image: Conference Center, Vancouver
Photo Credit: Wendy de Hoog





Absorbent landscape

Day-lighting streams

Rainwater harvesting

Detention tank

Wetland

Bioswale

Rain City Strategy

A high level, 30 year implementation plan that aims to manage rainwater sustainably through green infrastructure that

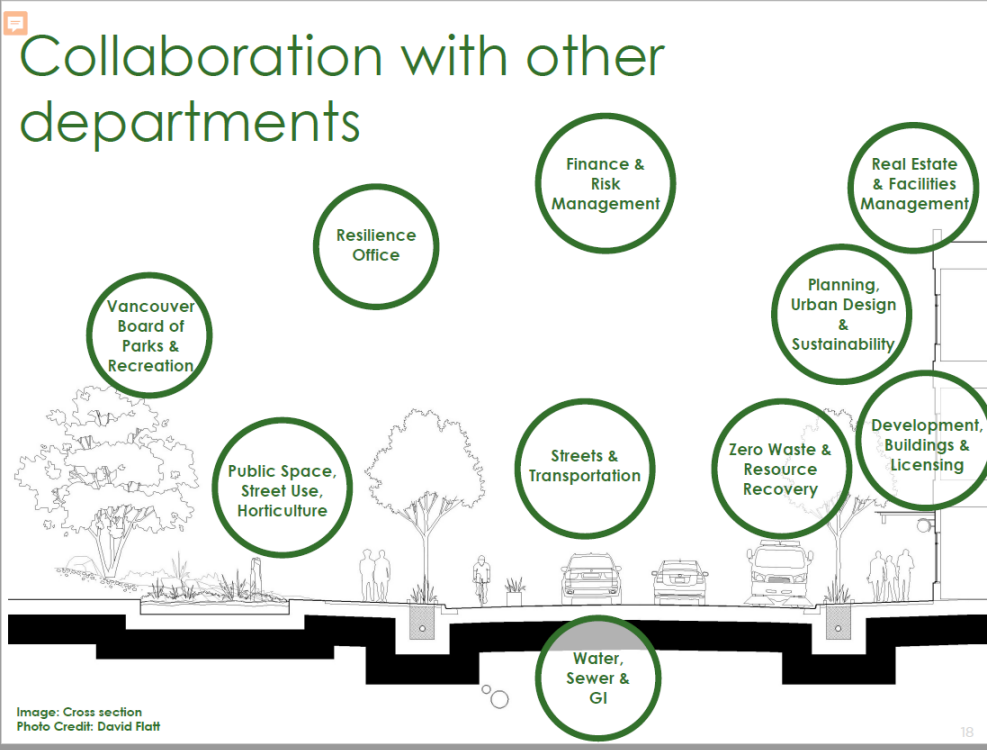
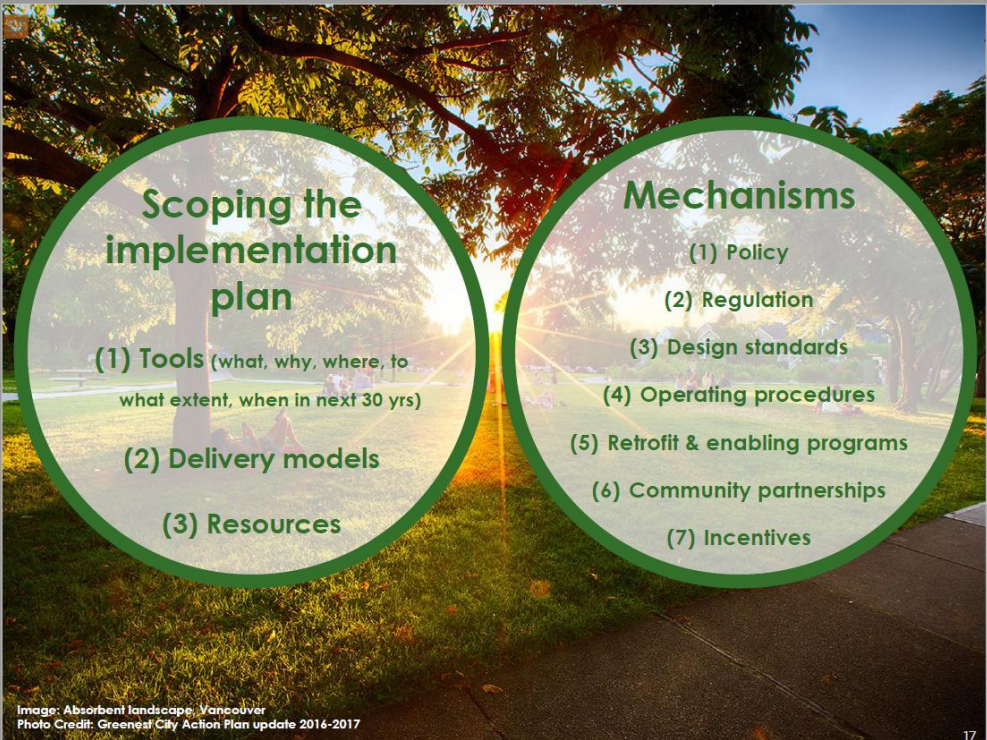
protects

restores

mimics

the natural water cycle

Image: Catch basin in bioswale at the East Fraser Lands, Vancouver
Photo Credit: Wendy de Hoog



Climate Adaptation Strategy

Urban Forest Strategy

Comprehensive City Building & Capital Planning Framework:
30 yr Strategic outlook

Greenest City Goals:
Green economy
Green buildings
Green transportation
Access to nature
Clean water

Habitat & Biodiversity Strategy

Resilience Strategy

Water Conservation Strategy

Healthy City Strategy

Intersection with a great number of city initiatives

Image: Swale on Yale, Seattle
Photo Credit: Alexandra Couillard

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Economics of green infrastructure investments

20

MANY CITIES ARE RETHINKING THEIR APPROACH: Economic imperatives for green investments (Chicago, Philadelphia and Washington DC examples)

Forbes | Billionaires | Innovation | Leadership | Money | Consumer | Industry | Lifestyle

5,023 views | Jan 22, 2013, 07:52pm

Smart Communities will Build Green Infrastructure

The communities of the future will be smarter about their use of resources. That seems inevitable. More investment is flowing to

SLATE

News & Politics | Culture | Technology | Business | Human Interest

METROPOLIS

Tunnel Vision

Chicago tried to dig its way out of urban flooding decades before climate change made it a national crisis. Did the city, and its imitators, pick the wrong solution?

By HENRY GRABAR

JAN 02, 2019 • 5:50 AM



Source: Municipal Natural Assets Initiative (MNAI) 2014. Definition and Scoping Natural Assets. Available at <https://mnaic.com/wp-content/uploads/2015/02/2014-01-06-Concept18-01-01.pdf>

WAMU | FEB 22

How D.C. Is Keeping Raw Sewage Out Of Rock Creek By 'Greening' The City



With a Green Makeover, Philadelphia Is Tackling Its Stormwater Problem

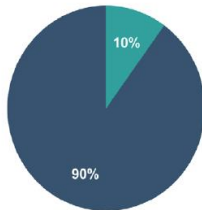
In a major initiative, Philadelphia is building an extensive network of rain gardens, green roofs, wetlands, and other infrastructure to capture stormwater. The goal is to prevent runoff from overwhelming sewers and polluting waterways and to help green America's fifth-largest city.

BY BRUCE STUTZ • MARCH 29, 2018

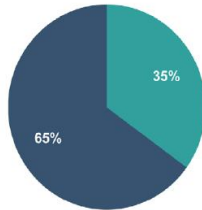
21

COMBINED SEWER OVERFLOW (CSO) MITIGATION COSTS: GI investments cost-effective & yield high performance (City of Portland Example)

CSO Program Cost



Gallons Managed



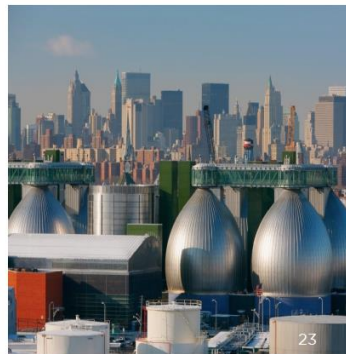
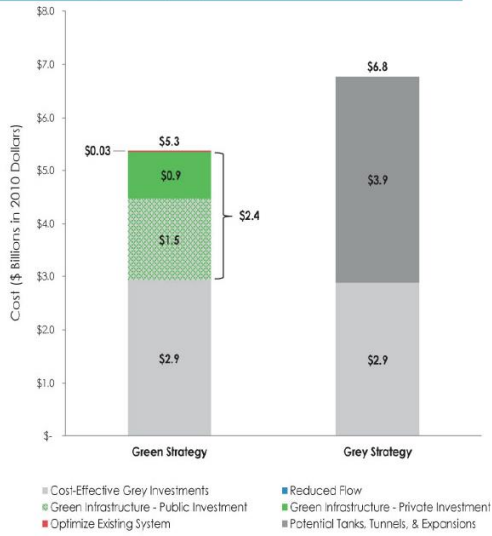
Green Grey



Source: Ville de Montreal Guide Technique en hydrologie Urbaine (Lasalle NHC Inc.), 2018. Rapport d'étape-revue de littérature technique Annexe - préliminaire.

22

CSO MITIGATION COSTS: Green-Gray vs. All Gray (New York City Example)



CSO Mitigation Costs: Philadelphia Water Department Low Impact Development (LID) vs. Grey Infrastructure

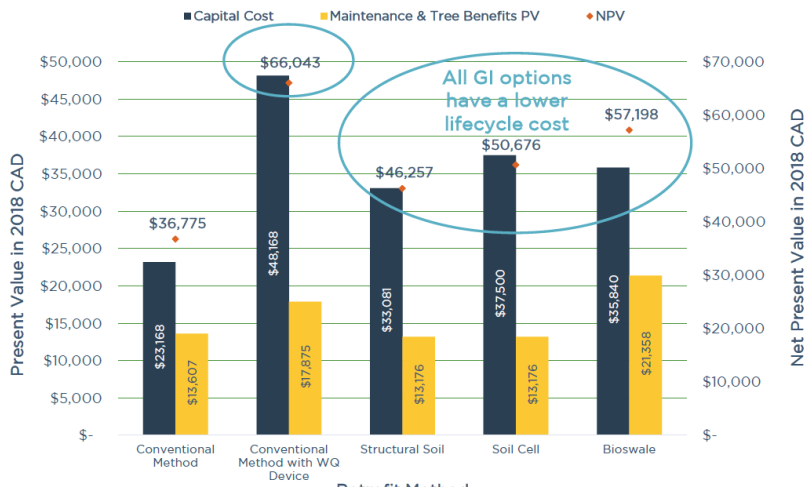
Benefits	> 50% Low Impact Development (Green Rainwater Infrastructure)	30" Tunnel (Grey Infrastructure)
Increased recreational opportunities	✓ \$ 524.50	✗
Improved aesthetics / property value	✓ \$ 574.70	✗
Reduction in heat stress mortality	✓ \$ 1,057.60	✗
Water quality / aquatic habitat enhancement	✓ \$ 336.40	✓ \$ 189.00
Wetland services	✓ \$ 1.60	✗
Social costs avoided by green collar jobs	✓ \$ 124.90	✗
Air quality improvements from trees	✓ \$ 131.00	✗
Energy savings / usage	✓ \$ 33.70	✗ \$ (2.50)
Reduced (increased) damage from SO2 and NOx emissions	✓ \$ 46.30	✗ \$ (45.20)
Reduced (increased) damage from CO2 emissions	✓ \$ 21.20	✗ \$ (5.90)
Disruption costs from construction and maintenance	✗ \$ (5.60)	✗ \$ (13.40)
TOTAL	\$ 2,846.30	\$ 122.00

* Parentheses indicate negative values

Stratus Consulting. *A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds*. Final Report, 2009 https://www.spa.gov/sites/production/files/2019-10/documents/gi_philadelphia_bottomline.pdf



PUBLIC REALM GREEN INFRASTRUCTURE: Rainwater Tree Trench Life cycle cost comparison



Source: Vega, O. 2018. *Application of Stormwater Tree Trenches in the City of Vancouver*. Available at https://sustain.ubc.ca/sites/sustain.ubc.ca/files/GCS/2018_GCS/Reports/2018-52%20Application%20of%20Stormwater%20Tree%20Trenches%20in%20the%20City%20of%20Vancouver_Vega.pdf

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RAIN CITY STRATEGY

9 Transformative Directions

1. Strive to become a **water sensitive city**
2. Accelerate action to protect the **health and vitality** of surrounding waterbodies
3. Revitalize **watersheds and waterfronts** to enable communities and natural systems to thrive
4. Shape systems to integrate and **value all forms of water**
5. Respond with urgency to **climate change**
6. Explore intersectionality, **equity** and Indigenous **reconciliation** through urban water management
7. Drive **innovation** and system effectiveness through data and analytics
8. Enable a culture of **collaboration**
9. Invest in education, capacity building and partnerships to **mobilize action**

27

3 Action Plans, 45 Programs

Streets & Public Spaces

11 Implementation Programs

5 Enabling Programs

Buildings & Sites

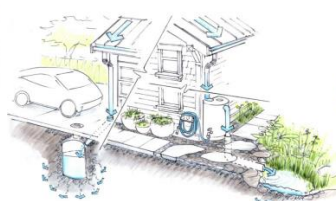
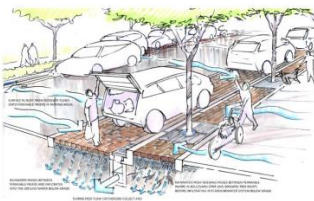
7 Implementation Programs

7 Enabling Programs

Parks & Beaches

11 Implementation Programs

4 Enabling Programs





1.9.4 *Summary of Tatiana Koveshnikova Presentation*

Tatiana Koveshnikova, Credit Valley Conservation Authority, Ontario

Tatiana describes municipal natural asset projects in the Credit Valley Watershed in Ontario. The goal of the CVCA as they implement these projects is to help municipal partners measure and manage the contribution of natural systems to municipal service delivery using asset management frameworks. Beginning in 2016 as an MNAI pilot there are now inventory and stormwater service assessments for natural assets (wetlands, woodlands and open spaces) underway across the watershed. The hydrological model developed in 2016 is being expanded and calibrated using monitoring data from the Region of Peel to refine its' performance and to calculate the size and costs of constructed infrastructure that would be required to match the existing stormwater management services. Condition assessment, risk assessment and monetary value of service provision are examined at two case study locations with

scenario outcomes analyzed. This will build the business case for natural assets, through analysis of management options; Do Nothing, Maintain Existing Service Levels, and Enhance Existing Service levels.

PowerPoint Presentation by Tatiana Koveshnikova



CVC-led Municipal Natural Asset Projects: Experience Up to Date

Advancing Municipal Natural Infrastructure Management in Alberta

September 19th, 2019

By Tatiana Koveshnikova,
Senior Coordinator, Ecosystem
Goods and Services



Conservation Authorities in Ontario



- Safeguarding Ontario's rivers, lakes and streams

- Protecting, managing and restoring Ontario's forests, wetlands and natural habitats

- Protecting life and property from natural hazards such as flooding and erosion

- Providing opportunities for the public to enjoy, learn from, and respect natural environment

CVC-led Municipal Natural Asset Projects

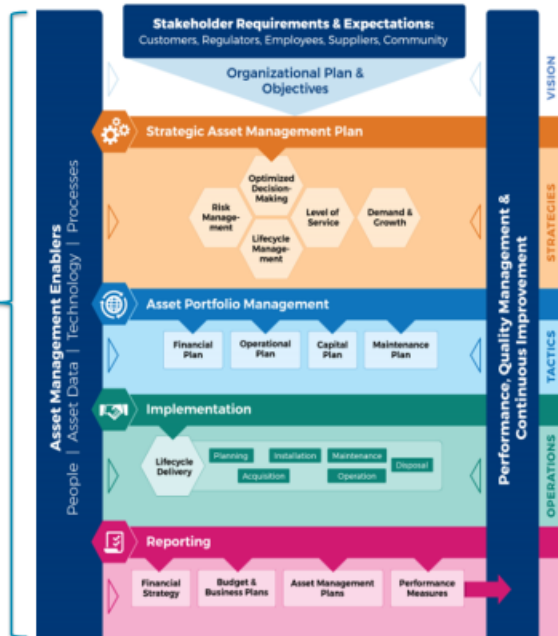
Project Goal:

Help municipal partners to measure and manage the contribution of natural systems to municipal service delivery using asset management frameworks



Project Rationale:

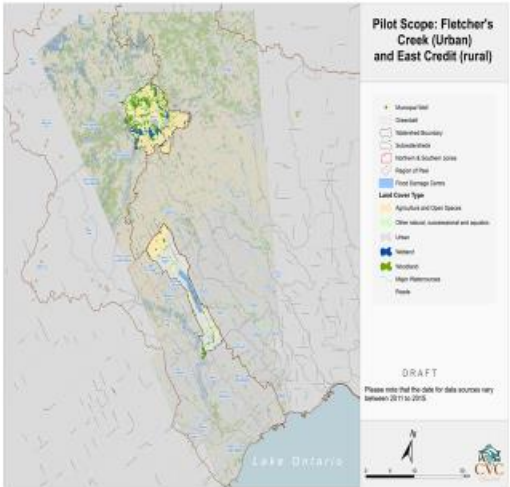
- Comply with the O.Reg.588/17: Asset Management Planning in Municipal Infrastructure
- Increase infrastructure asset portfolio resiliency to Climate Change
- Ensure sustainable provision of services



Natural Assets (NAs) Projects Timeline



Natural Assets: Inventory and SWM Services Goal, Scope and Approach



To develop and apply the model to:

- assess the level and value of SWM services provided by NAs (existing conditions);
- assess the impact of climate change on the level and value of these services

Study Area:	
• Pilot Phase	• 2 subs (2017)
• Expansion	• Region of Peel (2018)
Scope: Natural Assets	Wetlands (3 types), Woodlands, Open Space
Scope: Services	Peak Flow Reduction, Water Quality Control
Model/Valuation Method	EPA SWMM/ Replacement Cost

Approach to Natural Assets Valuation



Open green spaces



Forests/Woodlands



Wetlands – Isolated, Palustrine, and Riverine

- Selecting a representative Natural Asset (NA)
- Delineating catchment area (DEM, ArcGIS, Spatial Analyst and Arhydro)
- Dividing catchment area into Hydrologic Response Units (unique combination of land use, soil type, slope, and pollutant wash-off concentration)
- Acquire bathymetry or storage depth-discharge of NA.
- Calibrate hydrology model (EPA SWMM) based on available data – Groundwater levels

- Model NAs in EPA SWMM and determine **water quantity control (peak flow reduction)** and water quality control (**TSS and TP reduction**) under existing and future climate
- Remove NAs and determine size of stormwater infrastructure required to match flow/ water quality services provided by NAs
- Determine capital cost of required constructed assets to value existing NA's under existing climate and future climate (2065)

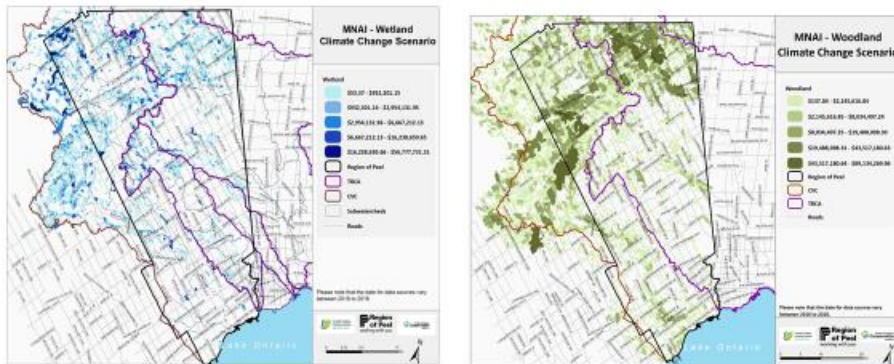
Rainfall depth (mm)	
Existing Climate	124.5
Climate Change (2065)	132.0

Results: Stormwater Quantity Performance of Natural Assets (Existing Conditions)

Natural Asset Type	Asset and Drainage Area			Design Storm (100-year return period)		
	Feature Area (Ha)	Drainage Area (Ha)	Imperviousness of Drainage Area	Volume in/out (m ³)	Volume Reduction	Peak Flow Reduction
Wetland 1: Palustrine	1.58	1.98	5%	3,192/2,010	37%	69%
Wetland 2: Isolated	1.11	13.9	5%	2,650/0	100%	100%
Wetland 3: Riverine	12.08	2,643	34%	2,005,050/1,980,330	1%	20%
Woodland	28.74	46.8	5%	57,776/34,602	40%	84%
Open Green Space	1.80	30.2	3%	15,361/13,950	9%	26%

Results: Equivalent Stormwater Storage Capacity

Natural Asset Type	Existing Climate Conditions		Climate Change Conditions	
	SWM Capacity Required to provide services equivalent to NA (m³)	SWM Capacity per unit Area (m³/ha)	SWM Capacity Required to provide services equivalent to NA (m³)	SWM Capacity per unit Area (m³/ha)
Wetland 1: Palustrine	874	246	934	262
Wetland 2: Isolated	5528	368 (177)	6284	419 (201)
Wetland 3: Riverine	59190	22	63675	24
Woodland	26550	351	29400	389
Open Green Space	4020	126	4303	134



Value of SWM Benefits (\$B) from Natural Assets in the ROP



Stormwater Quality Benefits

- Phosphorous Load Reduction
- Suspended Solids Reduction

Stormwater Quantity Benefits

- Volume Reduction
- Peak Flow Reduction

Lessons Learned

- Need to clearly define municipal asset-management process
- Opportunities for the natural asset valuation to inform existing plans and strategies (e.g., Climate Change strategies, Urban Forest and Parks asset management)
- Need to get on board staff with diverse backgrounds: planning, public works, parks and forestry, environmental and sustainability programs, and **asset managers**
- Need for a business case to demonstrate value of natural assets to municipalities (beyond the pilot and expansion)

Business Case for Natural Assets (2019)

Project Outcomes

- **Natural Asset Registry for 2 Case Study Locations**
 - **Condition Assessment**
 - **Risk Assessment**
 - **Monetary Value of Service Provision**
- **Scenario Analysis of Management Option Outcomes**
- **Interactive interface to Display Scenario Outcomes**



Management Scenarios

Based on the condition and risk assessments, we want to conduct a scenario analysis of:

- **Do Nothing**
 - What are the consequences of allowing the natural assets to succumb to the identified risk factors
- **Maintain Existing Service Levels**
 - What is required to address the identified risk factors to maintain existing service provision
- **Enhance Existing Service Levels**
 - In addition to maintenance scenario—what is required and what are the benefits of enhancing existing service provision

CVC-led Municipal Natural Asset Projects: Partners and Funders





1.9.5 *Summary of Michelle Molnar Presentation*

Michelle Molnar, Technical Director, Municipal Natural Assets Initiative (MNAI)

Michelle describes natural infrastructure from an economist perspective and understanding that our economy relies completely upon the environment. When our current conventional economy was developed, nature was not included as it was seen as limitless and manageable. We are now learning two fundamental truths 1) that nature is not inexhaustible, and 2) we rely on nature in more complex ways than we ever thought. This is being recognized by other stakeholders too, namely the insurance and finance industry. It is important to not just value the ecological services provided, but also to understand the cost of ignoring these services (the latter being more important). MNAI follows a continuum of valuation methods from market valuation (that are either direct or indirect) and assessing avoided damage (i.e. from potential avoided flood damages), to non-market valuation and methods

which utilizes market proxies or hypotheticals. Market proxies such as “revealed preference” can be used; for example, two homes with similar attributes should be the same price, but the one near an environmental amenity will have a higher value; this is called hedonic pricing and the different between the two houses could be considered the “value of the environment”). Hypothetical markets can be utilized to determine environmental value such as through “stated preference” (through a survey to determine what people are willing to pay), or “benefit transfer” (looking at other studies with similar ecosystems to determine the value of what the ecosystem service might be). MNAI uses a lot of revealed preferences. MNAI looks at what a municipality might do if an ecosystem service is degraded such as it cannot be used anymore, then they would look at where else those services can be provided; a value can then be determined. There is generally clear consensus in the literature on when to use each type of method to determine the economic value.

There are clear standards for asset management particularly around ISO standards, and MNAI has tried to include natural assets into that framework. MNAI asks municipalities to report on their natural assets in the same way that one would ask about traditional infrastructure; what is the inventory; what is the condition of the asset; what are the service levels; what are the risks; what is the value; what are the operations and maintenance plans to maintain it; how does it respond to changes in demand etc. MNAI also ask about their data and what would be required to answer the questions. MNAI also has a clear guide on how to take a municipality through the various stages of asset management. Along with templates to work with.

Questions asked to determine value include “What are the implications if an ecosystem is degraded to a point where it cannot provide services? What are the damages? What are the alternatives to provide this service? What is the cost of the damage and the service alternatives?” MNAI follows asset management standards and describes the MNAI resources available to help municipalities with the valuation and asset management approach.

PowerPoint Presentation A by Michelle Molnar



Advancing Municipal Natural Infrastructure Management in Alberta

MNAI AM approach and methodology for natural assets

Michelle Molnar: MNAI

September 19th, 2019

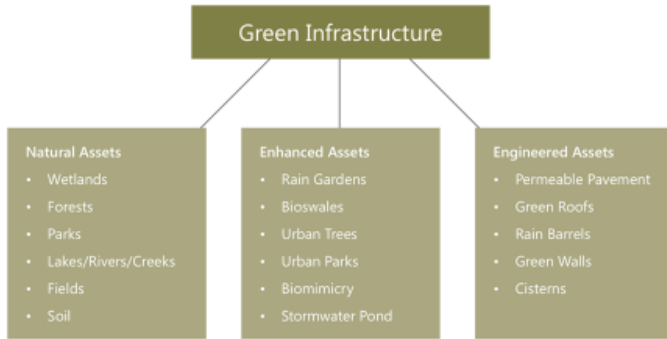
Agenda

2

- Defining natural assets
- MNAI methodology & tools
- Where to start
- Cohort 2 communities
- Technical issues (private land)

Defining natural assets

3



The term “municipal natural assets” refers to the stock of natural resources or ecosystems that is relied upon, managed, or could be managed by a municipality, regional district, or other form of local government for the sustainable provision of one or more municipal services

Figure 2. The terms natural asset and green infrastructure are often used interchangeably, but have different meanings. “Natural assets” refers to the stock of natural resources and ecosystems that yield a flow of benefits to people. “Green infrastructure” also includes designed and engineered elements that have been created to mimic natural functions and processes in the service of human interests (text and figure from Municipal Natural Assets Initiative 2017).

Methodology

4



Modelling steps:

1. Characterize the natural capital asset(s) of interest
2. Develop a list of alternative scenarios used to compare the natural asset(s)' services
3. Run a hydrologic model (SWMM) for all scenarios
4. Conduct economic valuation

Growing body of tools for natural asset management

5



Stormwater cohort 1 community pilots findings

6

KEY FINDINGS:

1. *Natural assets can provide equivalent stormwater management services*
2. *Under both climate change and intensified development scenarios, the value of natural assets increased*
3. *All pilot communities expressed that the initial results provided evidence for further investigation in to the value of other natural assets*



City of Nanaimo



Town of Oakville, Ontario



District of West Vancouver, BC



Grand Forks, B.C.



Region of Peel

Cohort 2 communities: Riverside Albert, NB

7

Natural asset of interest: Watershed (old growth Acadian forests)

Biophysical aspects: water storage and water purification

Services of interest: long-term availability of drinking water.

Scenarios: Climate change; Increased demand via population growth/ tourism



Cohort 2 communities: Riverview, NB

8

Natural asset of interest: Natural areas in new recreational development

Biophysical aspects: water storage

Services of interest: Flood protection; stormwater management

Scenarios: Climate change; changed to upstream forest management practices



Cohort 2 communities: Oshawa, ON

9

Natural asset of interest: Oshawa Creek corridor (south of the downtown core)

Biophysical aspects: water storage, filtering; slowing flow rates

Services of interest: Erosion control, flood protection and mitigation; maintenance of water quality; stormwater management

Scenarios: Climate change; Naturalization of riparian area along creek



Where to start?

10





Private Lands

11

- Land Use Tools:**
- Land acquisition
 - Conservation easements
 - Land use planning tools
- Incentives:**
- Payment for ecosystem services
 - Tax incentives
 - Offsets & trading systems
- Revenue Streams:**
- User fees
 - In lieu payment from development
 - Development cost charges
 - Provincial/Federal funding
 - Stormwater utilities
 - Green bonds



More Information: MNAI.ca

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Credit: Laura Berman



Follow us at

www.facebook.com/municipalnaturalassets/



Email us at

info.mnai@gmail.com





Advancing Municipal Natural Infrastructure Management in Alberta

Spotlight on Financial Planning and Reporting
Michelle Molnar: MNAI
September 20th, 2019

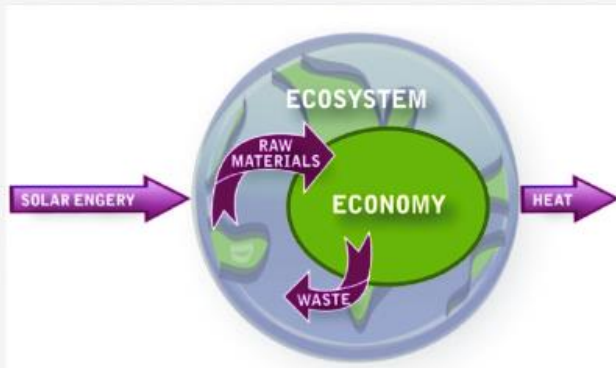
Agenda

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- View as an environmental economist
- Experiences with local governments
- Experiences with federal governments
- CPA conference

View as an Environmental Economist

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Key questions of discipline:

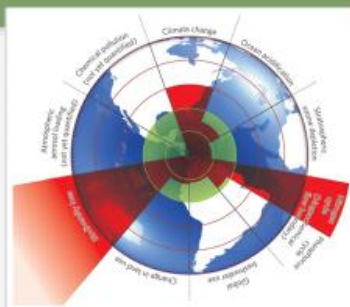
What is the relationship between the economy and the environment?

What are the impact(s) of an economy that largely excludes ecosystem services?

How do we structure our economy to recognize environmental limits and thresholds, while ensuring a high quality of life?

What kinds of things do we do?

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Application at local government scale

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Benefits of localized application:

- Ability to assess capacity of local ecosystems for stormwater management
- Ability to customize valuation to one stakeholder
- Together, these result in practical information for decision-making

- Local governments on the frontline and, of the different levels of government, they are the closest to the people and the land
 - Lower costs
 - Carbon neutral or even carbon positive
 - Can last in perpetuity
 - Climate change resilient
 - Improves risk management



Experiences with Federal government

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- Input into Statistics Canada Physical Flow Accounts (part of the Canadian System of Environmental-Economic Accounts)
- Presentation to the Office of the Auditor General Executive
- Interdepartmental meeting (INFC, ECCC, PC, NRCAN, TBS, HC, INAC)

Engagement with CPA Canada

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Along with 33 other organizations, MNAI made a submission to a consultation process that could open the door for natural assets to be properly considered in public sector accounting. Our recommendations included:

- Prioritise the inclusion of natural assets in Canada’s accounting framework
- Engage stakeholders
- Address valuation issues
- Require risk disclosure related to natural assets
- Develop a process to tackle long-term issues

Presentation at CPA Public Sector conference in Oct 2019

More Information: MNAI.ca

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Credit: Laura Berman



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1.9.6 Summary of Gracelyn Shannon Presentation

Gracelyn Shannon, Asset Management Coordinator, Town of Gibsons, British Columbia

DAY 1

Gracelyn describes the drivers and benefits of understanding the role of natural infrastructure from a service-based, asset management and system integration perspective. Gibsons starting point was to consider the entire “system as a whole” that provides municipal services. From this, their Council, their Chief Administrative Officer, asset managers, operators, finance leads and planners were able to recognize the full value of natural assets and the services they deliver. Natural assets are now integrated into existing processes including bylaw, development cost charges, asset management plans, policy, capital works and capital planning, as well as operations and maintenance budgets. Benefits include better monitoring and management of their aquifer, cost reduction for developers and taxpayers, lower organizational risk, and improved service delivery. A project example includes address capacity issues by building a natural asset (expanding an existing park & new ponds) instead of increasing pipe capacity at only 25% of the cost.

DAY 2

Gracelyn describes Gibsons experience with financial planning & reporting of natural assets. While reporting is very regulated and guided by the Public Sector Accounting Board (PSAB) they have made changes to financial planning by including natural assets. This started by recognizing the assets that are essential to providing the services of clean drinking water (aquifer) and drainage (ponds & streams). As a result, they now have an aquifer mapping & monitoring program and have included pond & streams in their integrated stormwater management plan. They also have budget line items for operations & maintenance of the aquifer as well as ponds & streams and used this to update the DCC bylaw update.

PowerPoint Presentation by Gracelyn Shannon

(no PowerPoint presentation was given)

1.9.7 Summary of Ryan O'Grady Presentation

Ryan O'Grady, Director of Engineering Services, Town of Courtenay, BC

The Town of Courtenay BC is a part of the MNAI second cohort of projects. Having experienced massive flooding from the cumulative impact of high rainfall events, upstream dam management practices and sea level encroachment it was recognized that land use and stormwater management decisions are critical to manage and adapt to the current risk level. Additionally, the introduction of more stringent drinking water quality guidelines resulting in months of boil water advisories drove home the value of protecting existing natural assets to avoid the cost of enhanced water treatment. Consequently, Courtenay has embarked on including natural assets in their asset management process, developing a stormwater strategy and is implementing source watershed protection measures through critical lands acquisition. Ryan also provides insight from his work with Engineering BC to begin developing a natural asset management practice guideline. He emphasizes the importance of thinking of the services first and how to provide that in a cost-effective way, and the assets second. This may result in shifting toward a naturalized option rather than a traditional grey infrastructure solution.

PowerPoint Presentation by Ryan O'Grady

(no PowerPoint presentation was given)

1.10 PRESENTATION IN THE EVENING EVENT

The following slides were presented as well as a summary of the speaker's evening presentations are provided below.

Welcome

Advancing Municipal Natural Infrastructure Management in Alberta



Evening speakers:

Gracelyn – successfully incorporated natural assets into the AM plan, cross-corporation initiative with development industry support as park and pond upgrade was much cheaper than a \$4 million pipe. Bylaws, asset management framework, operations & maintenance budgets have natural assets as a line item, also capital projects, had a capital project that delivered services at .25 of the cost of hard infrastructure – developers save money and are happy with it – great to have everyone working on the same goal.

Isabel Gordon – lack of asset management / infrastructure maintenance and investment. Foolish to replace with the same when necessary, rather replace with something better and pay a little more for it. Need cooperation of private property owners, as there is a lack of publicly-owned land base. Stream daylighting project, culvert replacement compared to daylighting, but then riparian setbacks, private property, school site conflicts. Educate based on lifecycle costs, but getting them can still be challenging. Keen until it's in their backyard. Natural capital asset inventory / valuation / cost projections.

Melina – Rain City Strategy. Redevelopment, sewer capacity as main drivers. Shared responsibilities, how can private industry and development bring innovation to rainwater management. Culture of urban design and focus on well-being. Similar issue as garbage – used to be able to put out as many bags as you want – now the shift is to zero waste. No discharge from private sites requires need for innovation from public and private sector to manage 48mm/day in a fully built up environment. Solutions include water reuse, parkades for infiltration, greater soil depth on top of underground parkades, can manage water on a single family home site with low cost but will cost more on public land. It has been a challenge for the city to take risk and allow developers a chance to do things that might not work yet – working with leading edge developers and the middle ground and then regulation for those who resist. \$70 million over next 4 years in budget.

Ryan O’Grady – flooding and sea level rise as a significant driver over the past 10 years. Changing demographics are leading to higher expectations for service delivery. CAO is co-chair of Asset Management BC, lots of inventory, condition assessment, capacity assessment. Watershed stewardship groups, highly educated people, easier to make the business case as having to upgrade existing infrastructure was difficult so permeability was a good option. Working with Engineering and Geoscientists BC to make a standard of practice for natural asset management to answer the questions of what is it, who does it, and what’s next. Shared service goals have brought different groups together including conservationists and emergency management. Provincial funding hinges on asset management plans, so this step is mostly complete. Standardized process for engineering and finance is needed, and framework from the MNAI is helping.

Michelle Molnar – how to work with communities, ecology and economy. How to build a framework for natural asset management (Gibsons as first project). Created a valuation of multiple wetlands in the park in Gibsons. Started to scale up the process to further develop the framework, working on a watershed scale in Ontario. Working on the proof of concept, guidance documents to walk through natural asset management implementation. What is their condition and can they be improved? What is their value? How does the asset respond to changes in demand? How do you build operations and maintenance into the long term? Have focused on stormwater management currently, starting to look at natural infrastructure for urban heat island impacts.

Q - Problem wildlife in cities – how are some of the negatives addressed?

A – Problem wildlife are a problem with or without AM. Coyotes and beavers are as much residents of Vancouver as people. Just live with them. North Shore, bear aware program, education around refuse, knowledge for residents, raccoons, cougars etc. Unfortunate encounters will happen, but this doesn't mean we need to control/remove them. Stacking biodiversity values in critical areas (Roy). Courtenay, bear training and earthquake training is part of the fabric. Nature as our original form of infrastructure, ecosystem services based on ecological processes. Healthy ecosystems have creatures and wildlife that we will need to live with and wildlife can be a resource for industry and tourism.

Q – Many partners, but what about the resource sector (i.e. logging and mining). How have they worked along with it, thinking of parallels in Alberta.

A – Courtenay as a logging community, everyone is directly or indirectly related to the logging industry. Watershed project has logging as the key piece, 75% of lands in the watershed are actively managed forest lands, owned by the pension companies with an interest to making money. The relationship with logging companies and quantifying the value of the watershed allows a better opportunity to have conversations based on services provided. Purchasing forest managed land in the watershed to protect the watershed leveraging funds raised by a conservation group. To manage shellfish production natural infrastructure can help, stormwater and onsite septic from shoreline fishing communities have resulted in health impacts to the shellfish industry.

Mining industry and selenium concerns in water quality at Sparwood BC, Teck as a participant in the work, sharing of water quality monitoring data. Looking at additional solutions to address water quality issues. How to meet the community where it's at to address the issues, whatever they are.

Q – How to look at triple bottom line vs. ecosystem service vs. life cycle costs, how does the preservation of natural infrastructure and low impact development (LID) and gray and green etc. get valued?

A – Isabel: Various economic models available, avoided costs is key to building the case. How much to replace and how much to construct should be considered. Life cycle costs into AM for all assets, including natural assets. Maintenance costs built in from the time of construction / acquisition. Triple bottom line doesn't work; it's hard to quantify the environmental and social values to make them stand up to the hard economic values. Easy for Councils to ignore the "airy-fairy". Assets are providing a value in and of themselves, helps gray infrastructure work better, when things work better, we expect to pay

(value the higher stream of services so ok to pay more for them). Have to integrate along the whole spectrum, as we still need engineered along with natural.

Melina: Value for money, enhanced public space, access to nature and other value propositions. Money invested in rainwater management, enhanced public space, heat mitigation, biodiversity, not just pipes. Pipes are expensive and not resilient, can't be changed easily. Green infrastructure can be expanded, transitioned, life cycle cost based on 50-year life span. Compared to traditional pipe infrastructure, lower up front costs, more operational cost in sediment management and plant health, but at the end of its life it isn't a mega project to dig up again, more cost efficient renewal. Pipes are expensive and 1300 km underground pipes with 120M /year upgrades 5km of pipe. Looking for specific outcomes in water quality and quantity management.

Critical to note that green or natural solutions are often engineered, stamped etc., not an either/or but important to look at all the options.

Melissa: Understanding asset condition and risk, on-going operations and maintenance costs.

Melina: Explanation of "engineered" green infrastructure system. All stamped, engineered, bioretention solutions are Green Infrastructure. Slightly different than MNAI definitions of natural assets. Intersection of landscape architecture and engineering, need to look at all options to provide services.

Ryan: Going through the quantification process to get to a standardized framework to build understanding with Engineering and Geoscientists BC. Can the natural thing provide the service that is intended, on its own, in conjunction with another, rather than outright replacing the natural entity. One professional umbrella for the different professional bodies to work better in collaboration to achieve the shared goal.

Q: Land value?? Higher than ecosystem value?

A – Melissa: MNAI, values based on stormwater modeling and capacity to provide service. What is the reasonable approach for that community to understand the alternate for the community? What are people willing to pay and sociodemographic factors? Ecosystem values need to be similar. Getting an understanding of how healthy the ecosystem is, once defined literature is identified, how to save

resources, understand the ballpark value. Need to consider the perspective of where that value comes from; MNAI generally uses the local government perspective.

Need to define the services provided, and then value. Question from Chris Arthurs – what are those services? Drainage? Walkability? What does this mean?

Q: Development community: If they're tearing down or otherwise developing a natural asset how should the development community be engaged to make it a win for everyone. If we're saying natural assets have value.

A: Neighbourhood development guidelines, show infrastructure necessary to support development. Gibsons has started with considering what can stay, and what can be built, development cost charges/off-site levy can be lowered if there is some use of natural infrastructure.

Edmonton – shallow wetlands, get dug out to increase volume, doesn't have the same function or biodiversity. So the original services aren't maintained, but provides for more storage.

A – what's the service that is trying to be achieved. Any development has to demonstrate the service being provided.

A – (Roy) not saying that if natural assets have value, but that they do. If the value of services isn't calculated, then the value is arguably zero. By calculating a truer value, you have the basis for a more informed decision-making process.

Melina – Vancouver has one of the most progressive building codes in North America. Not about giving incentives for doing the right thing but give incentives for the ones that will be out front to start to move things ahead in the right direction. Give ways to support them in innovation. Pipes are full and overflowing, working with UDI in Vancouver, suddenly, the situation was that they may not be able to continue developing (based on sewer capacity). Cost of servicing sites may become prohibitive to any development at all, so GI may become the only way to permit development based on servicing capacity.

APPENDIX E – MUNICIPAL NATURAL INFRASTRUCTURE PROJECT

THE MODESTE NATURAL INFRASTRUCTURE PROJECT



WHAT IS NATURAL INFRASTRUCTURE?

Sometimes referred to as “green infrastructure” or “natural assets,” natural infrastructure consists of landscape features—such as wetlands, riparian buffers and forests—that improve water quality and lower the risk of flooding and drought.

The benefits of natural infrastructure include carbon sequestration, wildlife habitat, recreation and protection from severe weather events. By retaining and filtering water, wetlands reduce overland flooding and replenish groundwater supplies.

Natural infrastructure also extends the life of built, “grey” infrastructure, such as floodways, culverts, bridges, and water-treatment plants.

Researchers have begun to financially quantify these many benefits to society, and to understand the costs when natural infrastructure is lost.

THE MODESTE NATURAL INFRASTRUCTURE PROJECT

The Modeste Natural Infrastructure Project will evaluate the financial benefits of conserving and enhancing natural infrastructure on agricultural lands in the Modeste Creek watershed in Alberta, Canada.

Experts from the University of Guelph, InnoTech Alberta, and ALUS will work with local communities to understand how restoring natural infrastructure will improve water quality and reduce the impact of flood and drought.

Using modelling, they will evaluate scenarios where natural infrastructure is restored, enhanced and conserved to meet the needs of local and downstream communities.

A cost-benefit analysis comparing different combinations of natural infrastructure with built infrastructure will help create a knowledge base and value proposition for natural infrastructure investment from the public and private sector.

The Modeste Natural Infrastructure Project will also contribute to the creation of natural infrastructure. Through the ALUS program, 263 hectares (650 acres) of wetland and riparian areas will be restored or enhanced in the Modeste watershed.

ABOUT THE PROJECT AREA

The Modeste watershed is a sub-basin of the North Saskatchewan River basin, and is located upstream of Alberta’s Capital Region.

The Government of Alberta has identified the Modeste watershed as a priority for flood and drought mitigation, as well as an important area affecting water quality in the province.

The Modeste was chosen for this project because of the support provided by the North Saskatchewan Watershed Alliance’s Headwaters Alliance—a water-focused intermunicipal collaboration group established in 2014. Each of the five counties in the Alliance has a program to engage farmers and ranchers in the enhancement and protection of natural infrastructure: Parkland, Brazeau, Leduc and Wetaskiwin Counties administer the ALUS program, while Clearwater County administers the LandCare Program.

THE MODESTE CREEK WATERSHED



THE MODESTE NATURAL INFRASTRUCTURE PROJECT

PROJECT PARTNERS



ALUS CANADA

ALUS Canada is a federally-registered charity that partners with communities and farmers to restore and enhance natural ecosystems on agricultural lands. ALUS communities in the Modeste watershed—ALUS Wetaskiwin-Leduc, ALUS Parkland and ALUS Brazeau—will restore and enhance wetlands and riparian areas as a part of this project.

Contact: Lara Ellis, Vice-President, Policy and Partnerships: lellis@alus.ca
ALUS.CA



DEPARTMENT OF GEOGRAPHY, ENVIRONMENT AND GEOMATICS, UNIVERSITY OF GUELPH

Dr. Wanhong Yang's research program integrates economic, hydrologic, and GIS modelling to examine the cost effectiveness of agricultural conservation programs, with a mission to develop modelling tools for agricultural BMP assessment at both field and watershed scales. Modelling projects using his IMWEBs tool have taken place in Canada and the U.S.

Contact: Dr. Wanhong Yang, Professor and Chair, Department of Geography, Environment and Geomatics: wayang@uoguelph.ca
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INNOTECH ALBERTA

InnoTech Alberta's primary focus is to facilitate the conversion of applied research to economic, social and environmental benefits. InnoTech links basic research and commercial outcomes, in accordance with strategic directions set out by the Government of Alberta, by delivering specialized services for its government and industry clients.

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NORTH SASKATCHEWAN WATERSHED ALLIANCE

As a Watershed Planning and Advisory Council, the NSWA is a multi-stakeholder organization that seeks to improve the management of water quality, water quantity and the health of aquatic ecosystems by developing and sharing knowledge and facilitating partnerships and collaborative planning processes. The NSWA will contribute watershed data and advice toward this project.

Contact: Mary Ellen Shain, Watershed Planning and Management Coordinator: Maryellen.shain@nswa.ab.ca
NSWA.AB.CA



PARKLAND COUNTY

Parkland County, located just west of the City of Edmonton, is a vibrant and robust community that is proud of its leadership toward sustainability and its long-time support of stewardship on both public and private lands.

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PARKLANDCOUNTY.COM

FUNDING PARTNERS



The primary funder of the project is Alberta Environment and Parks' Watershed Resiliency and Restoration Program (WRRP). This project is funded in part through Natural Resources Canada's Climate Change Adaptation Program. Additional funding is supplied by the City of Edmonton, EPCOR and the McConnell Foundation.



ALUS PARTICIPANTS WILL RESTORE AND ENHANCE WETLANDS AND RIPARIAN AREAS IN THE MODESTE CREEK WATERSHED.