ECOMETRICS ANALYSIS REPORT:
NSRB ROADMAP OPTIONS ANALYSIS

PREPARED FOR: WATERSMART SOLUTIONS LTD

Alberta, Canada

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EcoMetrics

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1.0 Executive Summary

This report contains the EcoMetrics methodology analysis of several proposed adaptations being considered as part of a strategic roadmap to address water-related challenges in the North Saskatchewan River Basin (NSRB). EcoMetrics LLC, that manages the methodology of the same name, was retained by WaterSMART Solutions Ltd. of Alberta, Canada (WSS) to do an outcome valuation analysis as a component of their more comprehensive study in developing the roadmap and corresponding report.

The EcoMetrics analysis component was to evaluate selected categories of adaptations to identify, quantify, and value, in monetary terms, the co-benefits. Not all adaptations lend themselves to an EcoMetrics-type analysis, and some which may lend themselves to an EcoMetrics analysis are not yet defined enough to provide the necessary inputs to do the analysis. Therefore, this should be considered a high-level initial analysis.

The overall purpose of the Roadmap is to develop and implement a number of adaptations to address identified challenges and opportunities in the area related to water quantity, water quality, water governance, drought, flooding, and other aspects. Specifics vary from adaptation to adaptation, but in general the intent is to build regional resilience, reduce risk and shortages, as well as support growth through increased availability.

The analysis is from a comparative and predictive perspective. For consistency of terminology used in this report, the "outcomes" are the impacts to the region and stakeholders resulting from implementation of an adaptation(s). If the outcome is positive in terms of creating incremental value, then it is a "benefit." In this report, benefit is used interchangeably with outcome, but with the understanding that there are cases where an outcome may have a negative impact and result in loss of value (for example, flooded agricultural land no longer usable for production). These are reflected as negative values in this report.

Outcome valuation is a combination of ecosystem service and natural asset valuation with Social Return on Investment (SROI). Ecosystem service valuation is an approach to determine the value in monetary terms created for stakeholders, realized by leveraging functions and services provided by the environment, nature, and natural resources. SROI is a framework for measuring and accounting for the broad concept of social value, a measure of change that is relevant to people and organizations that experience it. This concept of value goes beyond what can be captured in pure, market-based financial terms, seeking to reduce environmental degradation and improve wellbeing by incorporating social, environmental, and economic costs and benefits into project valuation (SROI Network, 2012). For analytical purposes, SROI converts non-financial values into their financial equivalents, using both subjective and objective research to estimate those values. EcoMetrics LLC believes this is what makes SROI different from other forms of social-impact analysis, and therefore more valuable to funders and supporters.

This report provides a brief overview of the valuation methodology, project approach, objectives and adaptations, and key findings and assumptions made when completing the analysis. Finally, this report includes a discussion of the valuation results and recommendations.

The NSRB Roadmap identified a number of adaptations as explained in the full report by WSS, incorporated by reference herein. The adaptations can be generally grouped into the following categories:

- Leveraging Land Use Types as Nature-Based Solutions (NBS)
- Increased Storage for Various Uses
- Increased Storage to Mitigate Drought Issues
- Agricultural Opportunities
- Increased Municipal Water Use Efficiency to Support Growth

The category groupings were necessary because a number of adaptations were variations on the same activity in terms of EcoMetrics analysis.

1.1 Results of Valuing Benefits

The comprehensive benefits of the different options – which include social, economic, and environmental outcomes – were identified, quantified, and valued utilizing the EcoMetrics methodology. The major stakeholder groups that would benefit include:

- Academic
- Environmental Non-Government Organizations (ENGO)
- Government
- Indigenous
- Industrial
- Municipal
- Utility
- Environment
- General Public

Tables 1 through 4 reflect the value created, by outcome, for the five adaptation categories, as follows:

- Leveraging Land Use Types as NBS (Table 1)
- Increased Storage for Various Uses (Table 2)
- Increased Storage to Mitigate Drought Issues (variation of Table 2)
- Agricultural Opportunities (Table 3)
- Increased Municipal Water Use Efficiency to Support Growth (Table 4)

The fifth category to address drought resilience is actually a different way to describe the values in the additional storage adaptation category. Drought resilience is defined as value preserved per cubic decameter (dam^3) by having water volume available in case of drought. Hence the value created per dam^3 is the same, and is either additional value created under normal conditions, or value preserved under drought conditions.

Table 1: Outcome Values for NBS Land Cover Types (per acre)

Outcomes	Forest ($/ac)	Grassland ($/ac)	Riparian ($/ac)	Wetlands ($/ac)
Aesthetic Value	$1,431	$134	$775	$775
Agricultural Economy	N/A	N/A	N/A	N/A
Biological Control	$33	$45	Unavailable	$225
Carbon Sequestration Social Value	$73	$2	$73	$103
Drought Resiliency	Unavailable	Unavailable	Unavailable	Unavailable

Food Provisioning	N/A	Unavailable	N/A	N/A
Habitat and Biodiversity	$2,868	$425	$1,538	$3,451
Nitrogen Retention Social Value	($36)	($34)	Unavailable	Unavailable
Nutrient Cycling	$15	$15	Unavailable	Unavailable
Phosphorus Retention Social Value	($8)	($16)	$3,444	$3,444
Pollinator Population Support	N/A	$659	N/A	N/A
Property Value	N/A	N/A	N/A	N/A
Soil Formation	$25	$1,155	$151	$893
Soil Stabilization	$301	Unavailable	$301	$2,093
Water Filtration	$974	$974	$974	$974
Water Regulation	$534	Unavailable	$482	$482
Water Supply for Population Growth	$10,406	$204	N/A	$12,682
Wildfire Risk Reduction	N/A	N/A	N/A	N/A
Total Social	**$16,616**	**$3,561**	**$7,739**	**$25,123**
Market Value of Carbon Credits	$38	$1	$38	$54
Total Market	**$38**	**$1**	**$38**	**$54**
Total	**$16,654**	**$3,562**	**$7,777**	**$25,176**

Footnotes:

- Values are rounded up to the nearest dollar
- Values in red and parentheses are negative values, representing value lost or a cost
- N/A means the outcome is not applicable to the land cover type.
- Unavailable means a credible and verifiable proxy value could not be identified in the peer reviewed literature
- $0 means the outcome is not creating measurable value for the land cover type.

Table 2: Outcomes Values for Increased Water Storage (per dam^3)-Value Created or Preserved

Outcomes	Value per dam^3	10,000 dam^3
Enhanced Environmental Flows ($/resident)	$7,281	$22,954,566
General Recreation ($/visitor)	$77	$77
Physical Health ($/visitor)	$809	$809
Population Growth ($/dam^3) (9 persons/dam3 and $71,640 of Gross Domestic Product (GDP)/capita)	$644,760	$2,032,713,360
Total Social	**$652,927**	**$2,055,668,812**

Table 3: Outcomes Values for Agricultural Opportunities (per acre)

Outcomes	Value per acre
Aesthetic Value	$95
Agricultural Economy	$1,213
Biological Control	$24
Carbon Sequestration Social Value	$5
Drought Resilience	$78
Food Provisioning	$1,145

Habitat and Biodiversity	$1,823
Nitrogen Retention Social Value	($548)
Nutrient Cycling	$18
Phosphorus Retention Social Value	$324
Pollinator Population Support	$429
Property Value	$4,200
Soil Formation	$4
Soil Stabilization	($252)
Water Filtration	$170
Water Regulation	$11
Water Supply for Population Growth	$0
Wildfire Risk Reduction	$188
Total Social	$8,926
Market Value of Carbon Credits	$2
Total Market	$2
Total	**$8,929**

Table 4: Outcomes Values for Enhanced Municipal Water Use Efficiency (per dam^3)

Outcomes	Value per dam^3
Enhanced Environmental Flows ($/resident)	$7,281
Population Growth ($/dam^3) (9 persons/dam3 and $71,640 of GDP/capita)	$644,760
Total	**$652,041**

Values presented herein are for a single representative year, but some outcome values would be expected to recur each year if projected out beyond one year and therefore the results reflect a conservative view. Hence, the adaptations create much greater value over time.

Key findings include:

- Nature-based solutions that leverage different land cover types create value in a number of outcomes, with wetlands being the highest overall value per acre. Water retention is the most productive in terms of value created per outcome.
- Storage options provide value created or preserved mainly through supporting populations, which generates GDP/capita.
- Increased water availability supports agriculture, and agricultural land generates value in a number of outcomes.
- Increased municipal water use efficiency essentially translates into more water available to support population growth, which in turn creates more GDP. This would apply in the specific scenario where there is limited water availability as well as inability for municipalities to procure additional water licenses.

- Until more details about adaptations, or details about actual implementation of various adaptations are known, some outcomes can only be valued very generally, if at all. Some outcomes do not apply to all land cover types or all adaptations. To address this lack of information, Not Available is noted. To address the applicability issue, Not Applicable (N/A) is used.

2.0 Project Background

2.1 Background and Area Description

The Roadmap project will enhance understanding and trust in water management in the NSRB. The NSRB is facing challenges in several areas, including a growing population in the region with pressure for water supply and quality, economic growth, and climate changes. The main strategic goals of the NSRB Roadmap include enhancing the use of sustainable water management practices, conserving and restoring ecosystems to maintain and improve watershed health, maintaining or improving water quality, and advancing inclusive, shared governance in water management. Each strategic goal has objectives, rationale, and a description of action steps in order to build a comprehensive roadmap for water management.

Several adaptations are being considered by the NSRB Roadmap Working Group in order to achieve these strategic goals. Adaptations being considered include (but are not limited to) examples such as aquifer management, wetland restoration efforts, reuse projects, improving water security for Indigenous communities, and improving water quality in non-mainstem drinking sources. EcoMetrics LLC obtained the majority of the information regarding the options being considered from WSS, and via several resource documents, including reports on prior Roadmap work. The collaborative work completed by the NSRB Roadmap Working Group up to the point of this report was used by EcoMetrics to determine the value of as many outcomes as possible. Section 7 in this report explains how EcoMetrics translates water volume and acreage of land cover type into other metrics that allow for specific outcome quantification and valuation. A number of assumptions were necessary in order to provide quantified values for benefits at this stage, and those are also described in detail in Section 7.

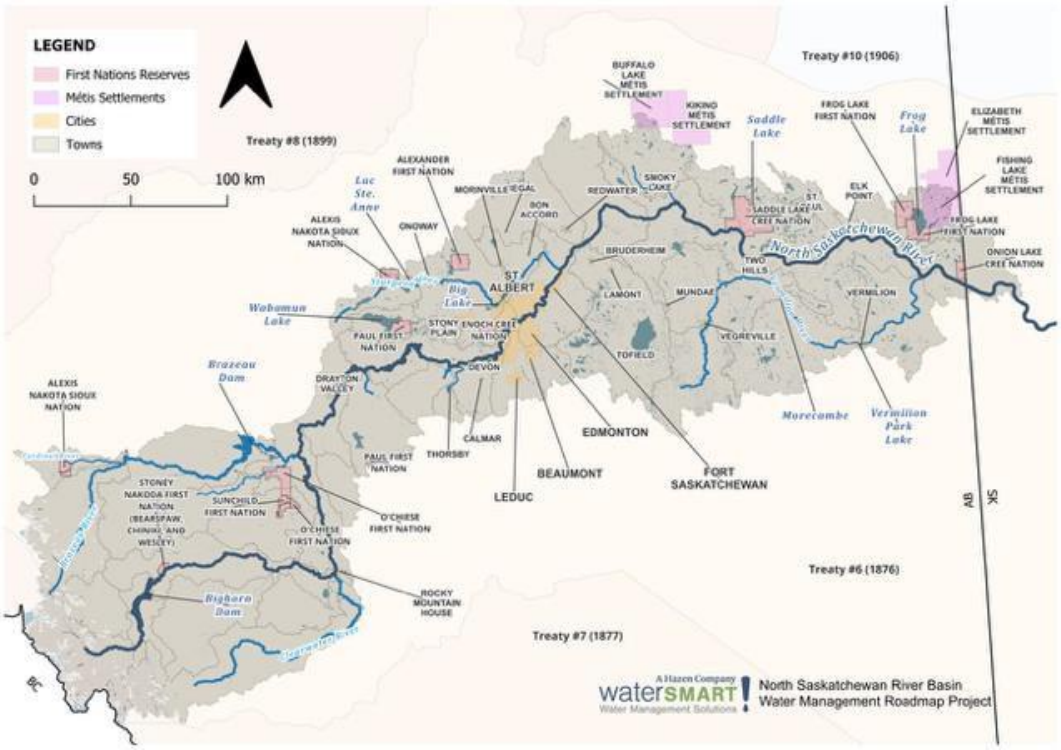

Figure 1: Location Map

The objectives of this report were to use the EcoMetrics methodology to:

- Identify and engage relevant key stakeholders affected by the water security and management adaptations in the NSRB – Understand what each stakeholder expects to change (objectives), what they contribute (inputs), what activities they do (outputs), and what changes for them (outcomes, intended or unintended) as a result of the adaptations;
- Measure and value the impacts of the possible adaptations – Understand the value created as a result of the changes experienced by each stakeholder group by using indicators to measure and quantify the outcomes and financial proxies to value the outcomes; and
- Create a forecast analysis to measure and evaluate the impacts of the possible adaptations – Articulate the key drivers of value creation and identify what data are needed to best measure and evaluate the impacts of activities.

A significant body of work which served as foundational information of the EcoMetrics analysis is presented in the full Roadmap report prepared by WSS and others and is incorporated by reference into this report.

3.0 Benefits Valuation and Methodology Approach

3.1 Description, Purpose and Approach of Methodology

EcoMetrics is a fully documented, third-party verified, and audit-ready assessment methodology supported with a cloud-based computational platform. It identifies, quantifies, and values the environmental, social, and economic value created by an activity or project, in this case, the Roadmap adaptations. The methodology emphasizes both process and results, utilizing stakeholder input, research, and site analysis. This necessitates thorough stakeholder engagement, supporting research, and an on-site understanding of the project's environmental, social, and economic consequences.

EcoMetrics analysis results serve three key purposes:

- **Financial:** Supporting business case development and return on investment calculations.
- **Communications and Reporting:** Facilitating internal and external reporting (both formal and informal), and communication efforts regarding project impact.
- **Scenario Planning and Assessment:** Enabling the comparison of value generated across various scenarios for evaluation.

EcoMetrics employs the principles of Social Value International's (SVI) SROI methodology combined with ecosystem services and natural asset valuation methods to perform the outcome identification, quantification, and valuation. SROI is a framework for evaluating the broader concept of social value, defined as change experienced by people and organizations. The Social Value Principles, with their strong emphasis on stakeholder engagement, guarantee that stakeholders have a significant input in evaluations, increasing the likelihood of their support for the findings.

While ecosystem services are commonly categorized by service type (e.g., regulating, supporting, provisional, or informational), EcoMetrics instead associates the outcomes by stakeholder group to better align with SVI principles and further ensure results are rooted in reality. This approach ensures that stakeholder perspectives are central to the assessment, although the outcomes can be organized in any way that supports the project's aims.

To account for the more intangible assets within a nature-based project, the environment is considered a stakeholder, as though it were a person or an organization. The specific outcomes associated with the environment were derived from scientific literature and research, and interviews with government agency officials that are responsible for environmental factors.

However, environmental benefits also have ancillary benefits to other stakeholders.

EcoMetrics research integrates scientific data on objective impacts into the SROI evaluation to comprehensively measure the effects of proposed options. This data directly corresponds to stakeholder-defined outcomes and quantifies the value of environmental, economic, and social changes. While "social value" refers to the incorporation of stakeholder input, it is recognized that stakeholders are also influenced by environmental and economic outcomes. The SROI methodology translates these social values into financial equivalents, enabling assessment of the cost-benefit of potential environmental actions. This valuation of outcomes clarifies the internalized financial and externalized societal benefits of investing in nature-based solutions.

There are two types of EcoMetrics analysis:

- Forecast: designed to understand and predict the desired impact and outcomes of an activity for affected stakeholders. Forecast analyses SROIs are especially useful in the planning stages of an activity. They can help show how investment can maximize beneficial impact and are also useful for identifying what should be measured once the project is implemented (SROI Network, 2012).
- Evaluative: conducted to set the baseline and/or retrospectively to validate a forecast or baseline SROI to understand if the impact sought was achieved. Evaluative analysis SROIs are helpful in assessing current conditions and determining the actual performance of a project underway.

EcoMetrics can be used for either forecasting, evaluating, or over time, both ways on a given project. Typically, the evaluative approach is used to establish baseline conditions against which forecasts can be compared. In this report, EcoMetrics is used as a forecast analysis on possible future adaptations for water management and security in the NSRB.

SROI was developed from social accounting and cost-benefit analysis and is based on the eight published principles of social value (SROI Network, 2012):

1. Involve stakeholders – Inform what gets measured and how it is measured by involving stakeholders;
2. Understand what changes – Articulate how change is created and evaluate this through evidence gathered, recognizing positive and negative changes as well as those that are intended and unintended;
3. Value things that matter – Use financial proxies so that the value of all outcomes can be recognized, including those that are not traded in markets but are affected by activities;
4. Only include that which is material – Determine what information and evidence must be included in the accounts to give a true and fair picture, such that stakeholders can draw reasonable conclusions about impact;
5. Do not over-claim – Only claim the value that organizations are responsible for creating;
6. Be transparent – Demonstrate the basis on which the analysis may be considered accurate and honest, and show that it will be reported to and discussed with stakeholders;
7. Verify the result – Ensure appropriate independent assurance; and
8. Be responsive – Pursue optimum value based on decision making that is timely and supported by appropriate accounting and reporting.

The EcoMetrics methodology integrates these SROI principles by developing an understanding of the activity being analyzed, how it meets its objectives, and how it works with its stakeholders. The SROI framework accounts for a broad concept of value and focuses on answering five key questions (Table 5).

Table 5: Key Questions Addressed by SROI Framework

Question	Definition
Who changes?	Taking account of all the people, organizations, and environments affected significantly
How do they change?	Focusing on all the important positive and negative changes that take place, not just what was intended
How do you know?	Gathering evidence to go beyond individual opinion
How much of this change do you cause?	Taking account of all the other influences that might have changed things for the better (or worse)
How important are the changes?	Understanding the relative value of the outcomes to all the people, organizations, and environments affected

Several concepts and definitions are important to understand throughout this process:

- Input: The financial and non-financial resources required to deliver the activities. Inputs may be owned by an organization or by those it is dependent upon.
- Output: The results of the activities (quantified where applicable).
- Outcome: The change(s) experienced as a result of an activity and its outputs.
- Stakeholder (people affected): The people who experience positive and negative outcomes.

EcoMetrics assesses outcomes by categorizing them as avoided costs, increased value, risk mitigation, or replacement costs. As further explained in Section 7.4.1 below, to determine value, the benefit transfer method is used, seeking the most similar, most current, well-researched and peer-reviewed, and documented scenario with existing value indicators. The precision of this estimation for the specific situation depends on the quality of the data and how site-specific information is available, with the preference for the most closely related locations.

Each outcome's significance for each stakeholder is evaluated based on quantity, duration, value, and causality. Four discount factors—deadweight (would it have happened anyway?), attribution (did something else contribute?), displacement (are there offsetting negative changes?), and

drop-off (does the impact persist?)—are applied in the evaluation. Deadweight is key for EcoMetrics' "Cost of Inaction" analysis, which compares the cost/benefit of not investing in natural capital or green infrastructure for the organization and stakeholders.

EcoMetrics places a particular emphasis on risk assessment. It considers the probability of external factors, such as severe weather, potentially negating the anticipated benefits. This is a crucial element in evaluating any potential investment in nature-based solutions. The methodology quantifies risk through both the application of the four discount factors and a thorough sensitivity analysis. The research team extensively documents sources and conducts sensitivity analysis on projected values and identified levels of deadweight, attribution, displacement, drop-off, and risk. This analysis generates scenarios enabling informed decisions. The Value Map facilitates comparability across different activities. The development of an impact map demonstrating the impact value chain for each stakeholder group is critical to this process. It links stakeholders' objectives to inputs (e.g., what has been invested), to outputs (e.g., number of acres restored), through to the outcomes (e.g., increase in biodiversity).

3.2 The EcoMetrics Analysis Process

The EcoMetrics methodology, listed in Table 6, generally consists of six stages (first two stages listed together), described in more detail in subsequent sections of this report.

Table 6: EcoMetrics Analysis Stages

SROI Analysis Stages
Establish scope and identify stakeholders
Identify outcomes
Quantify outcomes
Value outcomes
Report

3.3 Unique Aspects of Applying the SROI Methodology to NBS

NBS offer substantial environmental and societal advantages. Clearly articulating these benefits is crucial for acknowledging their significance, respecting the value they generate, and building a stronger argument for their protection, enhancement, and the necessary investments. This is not about assigning a monetary value to nature itself, but rather about understanding the worth of the goods and services it provides. This understanding allows for a logical comparison against more artificial and sometimes environmentally detrimental alternatives for providing the same goods and services.

EcoMetrics supports the applicability of the SROI approach to assessing environmental and ecosystem service benefits, as well as socio-economic impacts. This is because environmental and nature-based solutions projects differ from typical SROI projects. The benefits of NBS projects primarily involve changes to the environment and natural ecosystems, subsequently benefiting various stakeholders. The traditional SROI methodology requires supplementing with ecosystem services valuation concepts to capture these impacts associated with the environment. Traditionally, SROI has been used by community organizations focused on social welfare programs with clearly defined investment and benefit periods (Social Ventures Australia Consulting, 2011). In contrast, the benefits of nature-based environmental solutions are often not immediately obvious to stakeholders. For instance, while carbon, nitrogen, and phosphorus offset credits directly benefit funders and partners, the broader environmental value of these impacts for other stakeholders and society is typically not identified as an outcome through stakeholder engagement. Hence, the EcoMetrics methodology integrates ecosystem services valuation with the traditional SROI methodology.

3.4 SVI Certification

SVI provides an option where the entire work product is independently reviewed, and assurance and verification provided is reflected by certification of the work. This verification does not replace any benefit-specific independent assurance requirements that may be necessary based on how the information is used. For example, a carbon registry may require some degree of verification and validation of carbon sequestration claims. EcoMetrics can be aligned with such requirements for specific uses to facilitate that type of assurance. The SVI certification is an additional, overall level of independent assurance. The SVI certification is not required but is

important in that it focuses on the socio-economic valuation and validates that stakeholder engagement was robust and appropriate.

4.0 Stakeholder Engagement Methodology

4.1 Identifying Stakeholders

A key element of the EcoMetrics methodology is robust stakeholder engagement. Information and input necessary to define outcomes and provide credible valuation proxies depends on perspectives and anticipated changes as perceived by relevant stakeholders. The lead in pulling together the working members for this effort was the North Saskatchewan Water Alliance (NSWA). As a result of longstanding work under a collaborative lens, WSS has created lasting relationships with NSWA and other key basin and sub-basin stakeholders in the NSRB. Hence, it was decided to leverage and combine WSS' stakeholder engagement process with that of EcoMetrics to obtain the information necessary for the analysis.

The EcoMetrics analysis of the proposed adaptations was done in the broader context of the Roadmap effort. Therefore, being able to tap into that process for stakeholder engagement introduced consistency and efficiency. In order to adequately assess the integrated value creation of the proposed adaptations in the basin, EcoMetrics LLC utilized these existing contacts and the existing NSRB Roadmap Working Group workshop structure and timeline to conduct the EcoMetrics stakeholder engagement necessary for information gathering, data collection, and assessment.

The stakeholder categories capture the diverse cross-section of stakeholders involved in the Adaptation Roadmap for Sustainable Water Management in the NSRB process to inform water management decisions and identify project opportunities. Because of the large scale and wide geographic expanse of the potential impacts from the adaptations, and the relatively early stage of development of specific projects, stakeholder categories tend to be relatively generalized.

Table 7 and Figure 2 below show the distribution of self-identified stakeholder types in the EcoMetrics stakeholder engagement process.

Table 7: Stakeholder Groups and Numbers of Represented Stakeholders

Stakeholder Group	Number of Participants
Academic	3
ENGO	9
Government	16
Indigenous	3
Industrial	23
Municipal	7
Utility	1
Total	62

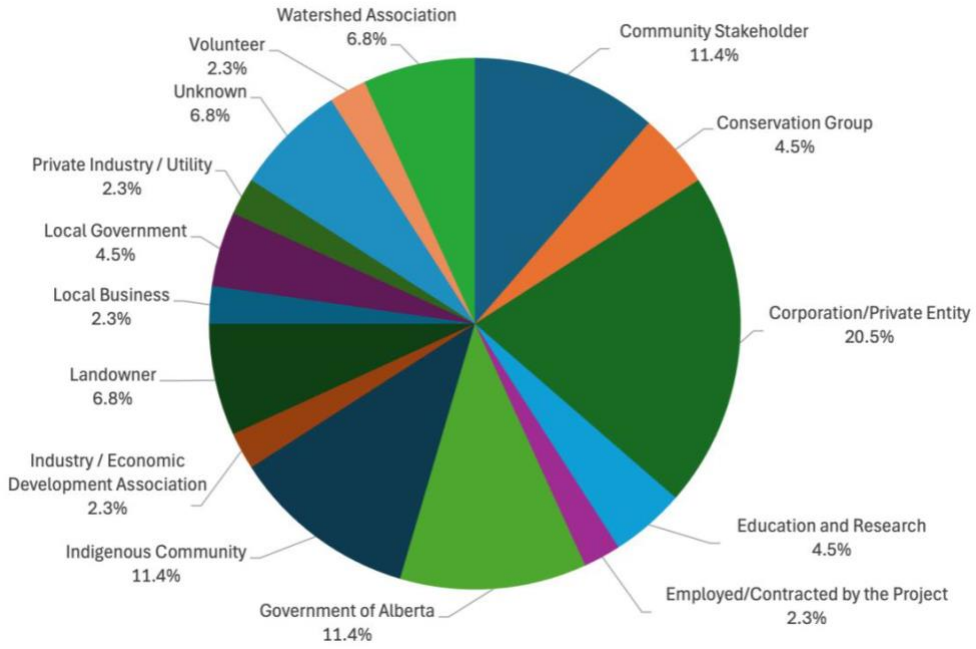

Figure 2: Stakeholder Roadmap Working Group Self Identification

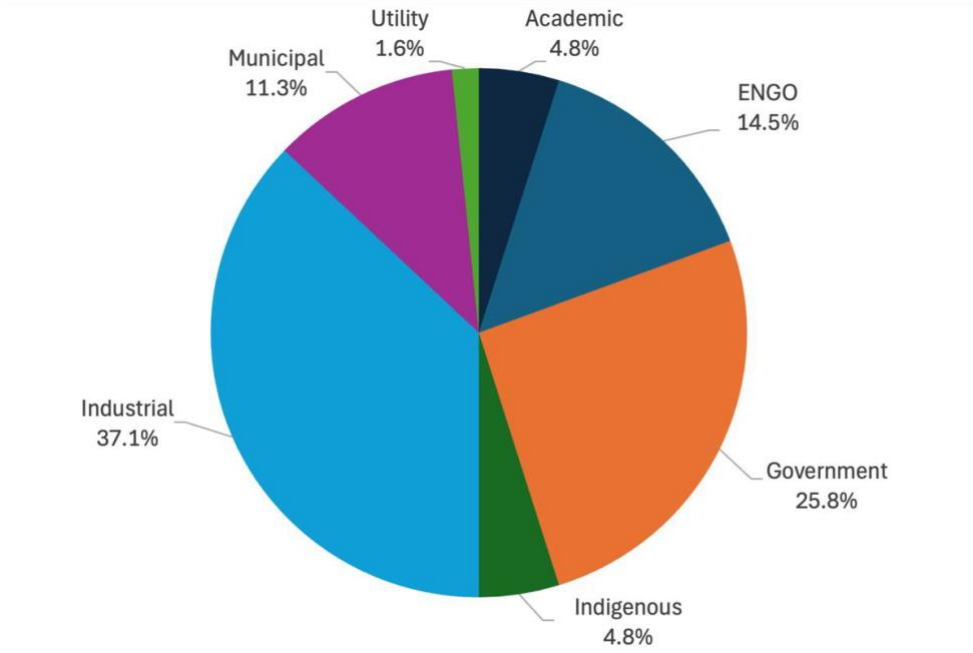

Figure 3: Stakeholder Representation Aligned with Working Group Composition

Figure 3 shows the makeup of the full working group as of November 2024. The distribution of stakeholder types for results is depicted in Figure 4. It is evident that the distribution of stakeholders that participated in the survey was a very closely representative sample of the entire working group participants. Review of responses allowed for fine-tuning of the outcome list and provided a sense of perceived value creation.

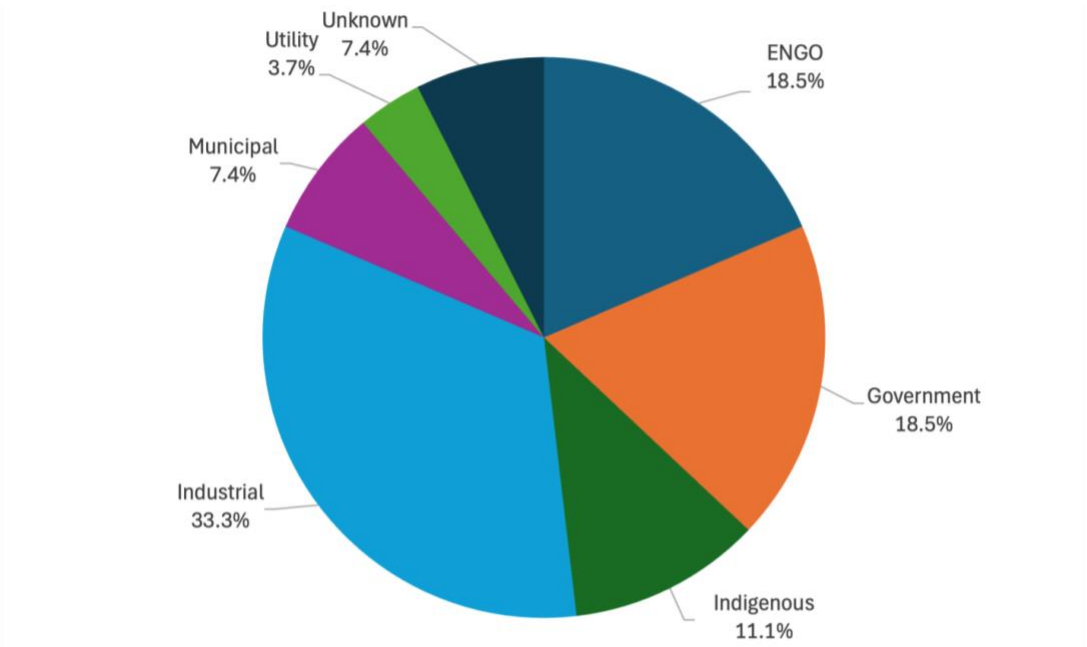

Figure 4: Survey Responses Aligned with Working Group Composition

4.1.1 Description of Stakeholder Groups

Environment

The environment is considered a stakeholder, but as it cannot speak for itself, other stakeholder groups, such as local government and recreational users, can serve as proxy stakeholders.

Representing the environment is also a role of some non-governmental organizations. Additionally, subject matter experts used by EcoMetrics LLC were used to represent the environment where appropriate.

General Public

As conditions evolve over time, in part due to climate changes, balancing the water supply and demand for sustaining a growing population while fostering economic development has become a significant challenge which has the greatest impact on the environment and the general public. The general public depends on access to clean water resources for a well-sustained population and sustainable agricultural production for their livelihood and well-being, even in the face of climate change. In addition, the general public benefits from a resilient and sustainable watershed through enhanced quality of life and community resilience aspects.

Local Economy

The local economy is a subset of the general public and captures many of those who also represent other stakeholder types, but this category is focused on the economic aspects of outcomes related to the proposed adaptations. This includes the economic development impacts of agriculture, tourism, recreation, and population growth. Stakeholders representing the local economy span regional industries, such as economic development authorities, oil and gas producers, agriculture, utilities and power generation, and other stakeholders representing private companies or industry.

Municipal Government

Proper management and protection of the environment are of interest to a number of government entities. These entities believe it is imperative to effectively manage shared resources for stakeholders while maintaining or enhancing ecological function, wildlife habitat, and ecosystem services. Also included in local governance are the various cities and towns that exist within the river basins. In addition, watershed associations and economically oriented agencies fit in this category. Municipal governments accomplish primarily through implementation, management, and enforcement such as implementing licenses and permits.

Provincial Government

Provincial governments have a similar overall relation to NBS impacts as do municipal governments but differ in scope of jurisdiction and role. For example, Provincial governments have broader authority, such as issuing licenses, creating laws and regulations, and incorporating Federal requirements.

Recreational Users

The watershed provides for aesthetic and recreational value for those who enjoy the outdoors, whether it be camping, hiking, bird watching, kayaking, or other activities. These stakeholders have a vested interest in the environmental wellbeing and long-term sustainability of the watershed and all the related ecosystem services. Although not interviewed as a separate group, many of the stakeholders involved in the EcoMetrics engagement are also recreational users in the area, and many comments and insights were provided regarding such use. In general, recreational users felt that enhanced environmental flows help increase recreational opportunities such as fishing, hiking, general tourism, and camping.

ENGOs

ENGO stakeholders active in the province and region provided critical perspectives to the Roadmap by offering a straightforward focus on the environmental and ecological outcomes from the various adaptations or interventions proposed. Being able to consider deeply informed observations of the potential environmental impacts for wildlife, vegetation, and aquatic life in the basin and subbasin was critical to the Roadmap process. Organizations included federal, provincial, and regional entities, with expertise and interests in a variety of environmental issues, species, and concerns.

Academic

Education and research stakeholders are included because the Roadmap provides a substantial case study in integrated water management. This project allows for a unique learning opportunity

that would be valuable to a variety of disciplines across a wide range of age groups. This project also provides research opportunities now and into the future, with the results of interest to other areas in the state and country.

Indigenous Communities

Local and regional Indigenous communities representing the original peoples of the area and their descendants were important stakeholders to the Roadmap process, sharing their multi-generational knowledge of the land, resources, and past, current and future management needs.

4.2 Outreach Strategies

With consideration of the long-term stakeholder engagement led by the NSWA in partnership with the WSS team to date, EcoMetrics LLC determined it was useful to tap into existing WSS NSRB stakeholder workshops to meet with and interview key basin stakeholders. Using a pre-approved interview guide aligned with SVI principles, stakeholder engagement involved mixed qualitative and quantitative questions, which can be found in Appendix I, to be able to measure perceptions of change and outcomes, and describe what those numerical attributions meant to each participant and their relative stakeholder groups.

4.2.1 Workshops and Working Group Meetings

EcoMetrics conducted its stakeholder engagement in conjunction with a WSS-hosted NSRB Roadmap Working Group workshop that was held on November 13, 2024, in Edmonton, Alberta. The workshop hosted 62 attendees. In that workshop, several breakout groups were guided through a series of questions derived from a Facilitator's Guide provided by EcoMetrics staff (Appendix I and II). Each group was asked to identify geographical areas of significance, as well as pointed questions related to possible outcomes envisioned by the stakeholders when considering the impacts of the various adaptations or interventions proposed. Survey participants were asked to rank the outcomes in order of importance to them or their organization/stakeholder group.

EcoMetrics attended the Roadmap Working Group meetings in February and May 2025 to participate in the discussions of adaptations, present results, and solicit feedback and reactions from the working group participants. All meetings are listed in Table 8.

Table 8: Dates of Outreach and Engagement Activities

Date	Activity	Location (if applicable)	Parties Involved
November 13, 2024	Stakeholder Workshop	Edmonton, Alberta	WSS, EcoMetrics, NSRB Roadmap Working Group
February 25, 2025	Working Group Meeting	Edmonton, Alberta	WSS, EcoMetrics, NSRB Roadmap Working Group
May 6, 2025	Working Group Meeting	Edmonton, Alberta	WSS, EcoMetrics, NSRB Roadmap Working Group

5.0 Theory of Change

Typically, a theory of change describes and summarizes the objectives, inputs, outputs, and outcomes related to different stakeholder groups (Social Ventures Australia, 2011). Additionally, a theory of change is a pathway linking the short-term, medium-term, and long-term outcomes

experienced by these stakeholder groups (Ireland, 2013). The theory of change described here delineates how varying stakeholder groups experience and perceive material change resulting from inputs to outputs, and ultimately to outcomes. The logic flow for the theory of change is illustrated in Table 5.

Table 9: SROI Mapping Stages 1 and 2 – Impact Map

Stakeholders	Inputs	Intended / Unintended Changes	Outputs	Outcomes
Environment	Ecosystem services, natural resources	Positive changes to various environmental parameters, especially environmental flows in the rivers, and agriculture-related enhancements	Enhanced environmental conditions	Restored, preserved, conserved areas, biodiversity, and wildlife linkages
Local Economy (includes Industrial)	Labor, purchasing of goods and services	Stronger agriculture-based economy, support population growth, tourism and recreation economy	Positive return on investment	Economic development growth
General Public (includes ENGOs, Academic, Indigenous Communities)	Support and participation	More water available, better quality of life, cleaner environment, stronger economy	Multiple benefits to the community reflected in various outcomes	Financial, economic, social
Recreational Users	Participation, use of resources	Will have a place to experience natural features from an environmental, social, and cultural perspective in part due to enhanced environmental flows	More and better recreational opportunities	Local economic development, quality of life improvement
Local Government	Technical support and public trust	Different agencies have varying expectations and can include water quality improvement, water balance, biodiversity, source water protection, cultural site protection, and others	Enhanced environmental conditions, contributing towards agency missions	In-kind

Key, Description of columns:

- Stakeholder: Who do we have an effect on? Who has an effect on us?
- Stakeholder Subgroup: Can the stakeholder group be broken down into easily quantifiable subgroups? Intended/unintended changes: What do you think will change for them?
- Materiality to subgroup: Relevance/significance of change to stakeholder groups. Consistent with materiality Inputs: What?: What do they invest?
- Value: What is the value of the inputs by description or in currency?
- Outputs: What changes as a result of the inputs?

6.0 Analysis of Outcomes

The following paragraphs describe anticipated changes experienced by stakeholders as they were described in the workshop hosted on November 13, 2024, with key stakeholders.

Stakeholder engagement was conducted as part of the EcoMetrics analysis of the project to better understand the anticipated outcomes of interest or concern for each stakeholder group. To achieve this input, EcoMetrics interviewed groups of stakeholders during the organized workshop as explained in section 4. These stakeholders represented one or more of the stakeholder groups identified. Information received during the guided interviews conducted in these working groups was then analyzed by the EcoMetrics team to inform the identification, quantification, and valuation of the expected outcomes.

In total 62 stakeholders were interviewed through the working group process. A single individual may be counted as more than one stakeholder depending on their self-identified stakeholder group in the survey. This was done while avoiding a double-counting risk.

Table 10: Survey Results- Number of Mentions of Outcomes

Outcome	Mentions
Improved water supply/security	44
Total GDP Increase/Economic Growth/Municipal Growth	39
Water Treatment	33
Environmental Flows, Aquatic Ecosystems	29
Drought Mitigation and Supply Resilience	26
Water Governance/Equitable Water use	18
Habitat and Biodiversity	11
Increased Indigenous interactions	7
Cultural Value/Recreation	4

EcoMetrics uses a set of questions designed to learn from stakeholders how they perceive the change from prior or current conditions, what they expect from the proposed projects, and which they think will have the greatest beneficial impact on the subbasins and NSRB overall. (Appendix I). This questioning intended to help EcoMetrics LLC understand what impacts are expected from the proposed adaptations and what those impacts would mean to the specific stakeholder group. Where possible, EcoMetrics asked for a cursory ranking of impacts using a 1-to-5 rating system. Although not a rigorous statistical analysis, this did provide a sense of which outcomes were considered more important or impactful than others. To be able to compare results, interview results were entered into an Excel spreadsheet to allow quantitative analysis.

6.1 Outcomes Experienced by Stakeholders Engaged

All possible adaptations considered by the NSRB working group shared common themes:

- Increased water for agriculture
- Water supply for growing populations
- Flood and drought control
- Enhancing environmental flows

In terms of specific perspectives among the stakeholder groups, outcomes noted as follows

Environment

Generally, environmental outcomes were verbalized by other stakeholder groups but referred to improved ecosystems, especially in the rivers. Healthier river flows enhance fish populations. Although not specifically noted in the workshop feedback, subject matter experts with prior experience have noted that agriculture operations provide various environmental benefits to the environment such as biodiversity and water flows.

General Public (including Recreational Users)

The general public stakeholders benefit the most from each adaptation in a variety of ways. Those adaptations which will improve water supply, flood control, and environmental flows will

have the most direct impact on the general public by impacting their overall well-being and livelihood, resilience in the face of drought conditions, and the ability to sustain current and growing populations. Indirectly, the adaptations which improve agricultural success will benefit the general public in providing food security and maintaining overall quality of life. Agricultural operations also provide a series of ecosystem services that benefit the general public such as carbon sequestration and surface water quality improvement among others.

Local Economy

The stakeholder representing the local economy is a collection of other stakeholder types (e.g., industrial), but this category focuses on the economic development aspects. The stakeholder perceived the adaptations of greatest benefit to be those which improved water capacity and mitigated future water supply risks in the face of a changing climate. Adaptations which improved water supply, capacity, and quality were perceived to enable economic growth and development, relieving potential future resource constraints on population growth. Growing populations are considered a significant economic driver for local economic stakeholders interested in maintaining and expanding economic value in the region. The use of water for agriculture will expand the regional economic drivers created by the agriculture industry sector. Through increased environmental flows, river ecosystems become healthier and more sustainable, which in turn promotes more recreational use and tourism, adding to the local economy.

Municipal Government

In reviewing the potential adaptations to manage water supply risks and improve water capacity while protecting environmental outcomes, the local government stakeholders and the general public seemed to be the greatest beneficiaries of the projects identified for implementation. The local government stakeholders noted that any project which enhanced or sustained the local economy and economic activities were of the greatest priority and greatest benefit to the general public (their constituents). Of additional priority were projects which improved water supply, capacity, and quality to support a growing population. Municipal government stakeholders will experience a variety of positive outcomes because of securing water resources that support future population growth, and economic development in the region. Local government stakeholders also considered the perceived water quality benefits to be of added value over time because of these projects.

Provincial Government

Provincial Government stakeholders interviewed echoed similar positive outcomes identified by municipal representatives. Enhanced protection and resilience to both drought and flood were identified as valuable outcomes, as well as the ability of these projects to restore and maintain natural hydrology where possible, to support natural systems replenishment and ecological functions. The ability for these project initiatives to provide a long-term water management strategy was a tangible benefit for government stakeholders as it allows for the equitable and mindful allocation of water resources, and its benefits for a variety of stakeholders over time, investing in the overall equity of the landscape. First Nations relations are increasingly a priority for government programs and priorities, ensuring equitable co-management of shared resources between Indigenous and provincial actors.

ENGOs

ENGOs or those organizations driven by environmental health priorities focused on the ability of the adaptations identified to support healthy aquatic ecosystems throughout the watershed(s). By prioritizing actions which provide for improved water abundance (volume) and water quality, environmental actors perceive the range of environmental, ecological, and wildlife habitats in the area to be paramount outcomes from the proposed activities. Many identified the ability for these projects to provide quality ecosystem restoration where possible, resulting in the long-term ability to maintain, improve, and enhance natural hydrological functions and aquatic species health via river connectivity or enhanced water capacity. Beyond the direct ecological benefits, environmental groups perceived increased water supply and the minimization of discharge impacts as critical human benefits for the surrounding communities.

Industrial & Utility

A component of local economic stakeholders interviewed, many industrial and utility business representatives identified the significant opportunities for industrial and population growth in the basin. Maintaining water quality and aquatic health allows for increased reuse, which over time will minimize water withdrawal needs and long-term water treatment. This will add increased efficiency to their respective processes, resulting in a reduction in their overall water footprint over time. New technologies will also support this reduction in water use with improved water efficiency functions, while restricting agricultural runoff. More efficient water use and reuse will also provide for great water supply to support future industrial and utility growth in the region.

Academic

From an academic perspective, stated outcomes of value include the ability of these proposed projects to maintain or enhance natural hydrological function and flow. Maintaining or improving water quality is essential for the desired environmental outcomes, and a focus on reuse is seen as an exponential value to the basin in protecting the overall water quality and quantity of resources in the basin.

Indigenous Communities

Indigenous or First Nation communities prioritize long-term water availability and resilience of water resources over time. Water health and access is significant to Indigenous livelihood, identity, and culture in the region and is paramount as an outcome in the basin for this stakeholder group. Those interviewed identified the value of Indigenous input in project prioritization and deployment, integrating “Indigenous methods” and deep understanding of the water resources, water constraints, and water management opportunities in the basin. With Indigenous involvement, knowledge, and stewardship integrated into the planning, execution, and stewardship of these projects, it is believed there will be more positive outcomes to all stakeholders over time.

6.2 Quantitative Analysis of Stakeholder Input Data

To better understand the data provided by the stakeholders engaged in this effort, select statistical analyses were performed. In the analysis, stakeholder input was organized by stakeholder category. If the stakeholder self-identified with more than one group, that representation was honored while avoiding double-counting risk.

In the workshop breakout session survey, stakeholders were asked to score each of the anticipated outcomes they identified on a scale of 1 to 5 for likelihood of the outcome occurring, how beneficial the expected consequence would be, and how widespread they felt the impact would be. This ranking exercise allowed the stakeholders to give a sense of their perceived impact of the outcomes. Caution must be taken when analyzing this ranking in that stakeholder perspectives of what an outcome is varies, and there is likely overlap.

7.0 Results

7.1 EcoMetrics Approach to Benefits Analysis

As noted in Section 3.1, the SROI approach is one that starts with input information and feedback from stakeholders and ends with a compilation of quantified and valued outcomes. The process is illustrated and documented in an SROI Map. For this report, EcoMetrics LLC integrated the SROI Map into a series of progressive tables that start with basic inputs and progress to a table that gives final, corrected and adjusted values for each outcome identified.

EcoMetrics divides the SROI Map into four stages, and sections 7.2, 7.3, 7.4, and 7.5 reflect these stages. Section 7.6 is devoted to explaining the various SROI corrections that must be applied to initial outcome values in order to get a more accurate and truer picture of value created by the adaptations. Figure 5 is a conceptual flow diagram illustrating the SROI Mapping process.

7.2 Inputs and Outputs- SROI Map Stages 1 and 2

The critical input is the direct financial investment in implementing the adaptations, where applicable. Table 9 in Section 5 reflects Stages 1 and 2 as defined above and represents the specific stakeholder types, and how they relate to inputs and expected outputs. As would be expected, a key output of the project is enhanced water management in the basin, which in turn triggers a number of impacts. These impacts, which include benefits, can be attributed to the stakeholders as those who stand to benefit by the value created or preserved.

Stakeholder categories used for the valuation analysis outcome groupings are based on those distinct groups that would be affected by specific outcome values. The groups used in the analysis are:

- The Environment
- General Public (Includes Indigenous Communities, ENGOs, Academic)
- Government (Includes Municipal and Provincial Government)
- Local Economy (Includes Industrial and Utility)
- Recreational Users
- Funders

This grouping differs slightly from the groupings used in the working group discussions and stakeholder engagement in large part because for the valuation component, the groups need to align with the specific outcomes associated with that group. Clearly, there is an overlap of actual individual stakeholders, and the benefit to the environment will manifest itself from a valuation

standpoint as impacts to other stakeholders. For example, improved aquatic ecosystems can mean more fish, thereby increasing recreational opportunities.

7.3 Outputs and Outcomes- SROI Map Stage 2 (Continued)

Once the outputs are known, changes can be determined based on research, direct observation, and stakeholder input. Table 11 builds on Table 5 by listing the outcomes identified by the stakeholders. Specifics on how these outcomes are defined and valued are explained in Table 11.

The table describes which outcomes were selected for this study as well as the stakeholder to which the benefit is assigned. There is some overlap between many of the outcomes and which stakeholder group benefits. To address this and to allow for more simplified interpretation, EcoMetrics assigns the benefit to the primary beneficiary. Ecosystem services are typically organized not by stakeholder, but by service type (regulating, supporting, provisional, or informational). It is possible to sort these outcomes in any manner that aligns with the project goals. For the purposes of this study, EcoMetrics organized these outcomes by stakeholder to address SVI principles.

Many of these outcomes have been defined and studied extensively in academic literature. In essence, a land type or volume of water would provide a combination of different benefits based on its inherent qualities (for example, trees in a forest provide levels of carbon sequestration, wetlands can effectively store water, etc.). Not all land types are assigned all of the benefits, and some land types may have higher values for certain benefits as compared to others. Also, the outcomes associated with using a volume of water to support municipal growth may vary from outcomes associated with the water if used for enhancing environmental flows. For adaptations involving using land cover types, proxy values are assessed either on an annual “per acre” value basis and for water volume-related adaptation, proxies are or on a per acre-foot of water basis. Non-acre or non-ac-ft values, though fewer, were calculated using the applicable metric, such as “per resident” or “per visitor,” also on an annual basis.

Figure 5: Conceptual SROI Mapping Flow Diagram

Table 11: Outcomes Definitions and Value Calculation Method

Outcome	Outcome Description (with conversion as applicable)	Calculation of Value
Biological Control	Management of a pest, weed or disease through the use of their natural enemies.	Number of acres is multiplied by the value of equivalent biological control by artificial means per acre per year, over the lifetime of the project.
Habitat and Biodiversity	Providing shelter, maintaining biological diversity and pollinator habitat that promotes healthy ecosystems.	Number of new irrigated acres per yr is multiplied by the value of habitat and biodiversity per acre per year, over the lifetime of the project.
Nutrient Cycling	Repeated pathway of particular nutrients or elements from the environment through one or more organisms back to the environment. Nutrient cycles include carbon, nitrogen, and phosphorus.	Number of new irrigated acres per yr. is multiplied by the value of nutrient cycling per acre per year, over the lifetime of the project.
Pollinator Population Support	Provisioning of pollinators for the reproduction of plant populations, based on the pollination value of cropland dominant regions. The foraging of bees is essential for the productivity of farms.	Number of new irrigated acres per yr is multiplied by the value pollinator population support per acre per year, over the lifetime of the project.
Soil Formation	Soil formation refers to weathering of rock and accumulation of organic material in respect to soil agricultural productivity and nutrient retention.	Number of new irrigated acres per yr is multiplied by the value of soil formation per acre per year, over the lifetime of the project.
Soil Stabilization / Erosion Control	Refers to the impact of increased deep -rooted vegetation, which contributes to the retention of arable land, slope stability, and erosion control. The costs associated with erosion include reduced soil productivity, damaged roads and structures, filled ditches and reservoirs, reduced water quality, and harm to fish populations. Rotational grazing will enhance growth of vegetation above and below ground.	Number of acres is multiplied by the savings on avoided erosion per acre per year, over the lifetime of the project.
Water Filtration	Removing water pollutants via soil filtration and/or their integration in the food chain via plants and microorganisms.	New irrigated acres per year is multiplied by the value of water filtration per acre per year, over the lifetime of the project.
Water Regulation	Slowing the flow of water that runs through the environment, ensuring adequate water availability for all water needs. Includes several services such as water retention and **storm flood protection.** It is closely related to erosion and natural water purification.	New irrigated acres per year is multiplied by the value of water regulation per acre per year, over the lifetime of the project.
Cultural and Aesthetic Value	Enjoying and appreciating the scenery, sounds, and smells of nature. Providing opportunities for communities to use lands with spiritual, religious, and historic importance.	Number of visitors per year is multiplied by the cultural and aesthetic value of river, over the lifetime of the project.
Carbon Sequestration – Social Value	Comprehensive estimate of climate change damages such as agricultural productivity, human health, property damages from increased flood risk, etc.	Tons of carbon sequestered per acre per year is multiplied by the number of acres and dollar per ton of carbon social value, over the lifetime of the project.

Drought Resiliency (for Agriculture)	Constant and secure flow of water for irrigation may decouple part to the climate change threats to food production.	Number acres is multiplied by the value per acre per year, over the lifetime of the project.
Food Provisioning	Producing crops, fish, game, and fruits.	Average revenue for food crops in Alberta in dollars per acre.
Nitrogen Retention – Social Value	Regenerative agriculture improves the soil by retaining Nitrogen. This protects downstream systems such as: wetlands, rivers, other farms and could reduce the operation cost in water treatment plants.	Tons of nitrogen retained per acre per year is multiplied by the number of acres and dollar per ton of nitrogen social value, over the lifetime of the project.
Phosphorus Retention – Social Value	Regenerative agriculture improves the soil by retaining Phosphorus. This protects downstream systems such as: wetlands, rivers, other farms and could reduce the operation cost in water treatment plants.	Tons of phosphorus retained per acre per year is multiplied by the number of acres and dollar per ton of phosphorus social value, over the lifetime of the project.
Property Value	Economic value of land (crop and pasture) in the province of Alberta.	(average $/acre of land used for agricultural activities) This is a one-time value, not annual.
Physical Health	Benefits to physical health obtained by enjoying nature and exercising outdoors.	Number of new visitors per year multiplied by the value of physical health, over the lifetime of the project.
GDP	Access to more water may result in population growth that will contribute to the economic development in the region.	Additional water for municipal use supplied by project per year divided by the average water use per person per year multiplied by the GDP per person per year in Alberta, over the lifetime of the project.
Enhanced Environmental Flows	Benefits obtained from releasing water into the river to supplement nature needs will make the place more attractive for locals and tourist who will come to enjoy the enhanced environment.	New population to be supported by the project) (average benefit of the recreation activity/person-yr.
Agricultural Economy	Economic outputs of the agricultural sector.	Number of acres times value per acre over the lifetime of the project.
Wildfire Risk Reduction	Reduced losses due to lower wildfire potential of land cover. Proper irrigation keeps soil and vegetation moist and lowers the risk of wildfires in the farms and surrounding areas.	Number of acres times value per acre over the lifetime of the project.
Storm Flooding Protection	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure.	Number acres is multiplied by the value per acre per year, over the lifetime of the project.
General Recreation	Experiencing the natural world and enjoying outdoor activities.	Annual benefits of recreation/person in Alberta multiplied by the number of inhabitants in Alberta, over the lifetime of the project.
Market Value of Carbon Credits	The revenue value of the carbon as transactable credits in either the regulatory or voluntary carbon markets.	Tons per acre times acres times dollars per ton.

7.4 Valuing Outcomes- SROI Map Stage 3

7.4.1 Financial Proxies

In summary, the EcoMetrics methodology determines the quantity of an outcome using peer-reviewed and accepted methods. These outcome quantities are then multiplied by financial proxies to determine the value created (or lost) by implementing the adaptation. Outcomes are related to using various land cover types as NSB or increase in water availability, and represent impacts and changes that would occur. In EcoMetrics, the effect of a specific land cover type or increase in water availability in and by itself is simply an output of the adaptation. The actual outcomes relate to what that output means in terms of change, and how it affects stakeholders. For example, more water means the ability to support a larger population, which in turn creates benefits by way of economic development.

For attaching values to outcomes, EcoMetrics used a meta-analysis and benefits transfer approach. The goal is to find the most up to date peer-reviewed materials to use for the calculation of financial proxies across outcomes.

For other parameters, EcoMetrics looked for the most applicable specific calculations beginning from local and regional information to the Canadian national level. Peer-reviewed figures from federal and provincial agencies were prioritized, depending on dates they were produced. Where these criteria could not be met for peer-reviewed proxies, recent national and international reports were used to make calculations, particularly for some of the more intangible benefits. The appropriate use and application of third-party proxies in this analysis was guided by internationally recognized standards.

Proxies were adjusted, as needed, to standardize units, currency, and inflation. Other corrections made to proxies include adjustments for formula inputs. If multiple proxies were deemed appropriate across different data sources for an outcome, an average was then computed and applied.

7.4.2 Market vs. Non-Market Values

EcoMetrics defines outcome values as “Market” and “Non-Market” values. Both are reflected in monetized terms, in this case Canadian dollars (CAD). However, Market Value is defined as a value that is directly realized by a stakeholder, usually as revenue to the funder or owner of the attribute. A typical example of Market Value is the income from carbon credit sale or direct revenue from the project. Other examples could be gains from the sale of real estate or the sale of goods and services.

Most values however are Non-Market and relate to value created for many other stakeholders. Because most outcomes benefit the environment, the general public, other key stakeholder groups in addition to site owners and funders, the overwhelming majority of value created is typically Non-Market value. A good example as noted below is agriculture development. A great deal of environmental, economic, and social value is created through agricultural land use.

However, this value is not direct revenue to the producers and growers. Instead, it is value realized by a much broader set of stakeholders who benefit from the related outcomes above and beyond the actual sale of crops or livestock. Agricultural land management has many positive

impacts to air quality, water quality, biodiversity, flood protection, and others – all of which provide tangible benefits to many stakeholders.

7.4.2.1 Market Values for Carbon, Nitrogen and Phosphorus

Carbon markets create a financial incentive for landowners to conduct management practices on their land to store carbon in the soil. Also, creating areas of specific land use types may increase the carbon sequestration per acre. Market values for carbon are based on general price ranges per ton in the various marketplaces where offsets are transacted. This per-ton value is different from, and independent of, the nonmarket "social" value of carbon. There is a great variety of market types and programs, ranging from informal bi-lateral carbon transactions to very structured and formal registries which act as central depositories of credits, and provide protocols and rigorous review of claims of sequestration. Some of these formal markets are regulated, but the overwhelming majority operate in the voluntary marketplace. If a project wants to register credits for transactions in these formal marketplaces, it will need to follow that registry's applicable protocols and methodologies, as well as defined monitoring, reporting, and verification. It is possible that a specific program or registry may require a methodology different from or in addition to how EcoMetrics calculates carbon sequestration. In essence, EcoMetrics can give a sense of the potential market value of sequestered carbon, but in and by itself does not serve as an application for registering credits with any specific registry.

Normally, values of nutrient reduction as tradable credits (Nitrogen and Phosphorus) would also be included in the Market Value category. These values should be interpreted as an "opportunity" value and assumed that all reductions due to land cover type would be available for transaction. However, there are only a handful of water quality trading programs in North America and trading programs have very specific rules. For example, some programs require that a percentage of reductions be "retired" and therefore not available for sale. Trading programs also have specific rules as to what reductions are acceptable, and the fact that the land cover retains a certain amount of nutrients does not necessarily mean it will be accepted as credits. Due to this uncertainty and lack of actual markets at this time, market value for nutrient reduction was not calculated.

7.5 Corrections- SROI Map Stage 4

In order to ensure consistency with the SVI Principles and the SROI process, it is necessary to correct the initial values of the outcomes to be more reflective of the changes that are actually due to the project or activity. In other words, we are determining the "net value impact." This is done via a number of corrections as defined in sections 7.5.1 through 7.5.8. Because this analysis was for predictive comparative analysis of the adaptations and focused on net change, many of the corrections required by SVI are either not applicable or have been modified as described below. In future updates to the analysis, as details and specifics become clearer on implementation of adaptations, these corrections can be applied. At this time, there is either not enough information and/or the correction is not yet applicable.

7.5.1 Deadweight

Deadweight is defined as the percentage of a benefit that would have occurred anyway, if none of the changes defined by the scenario were to occur. As this is a comparative analysis, deadweight issues have been addressed by doing a separate analysis for each adaptation and

focusing only on the incremental increase in any outcome. This approach accounts for the deadweight concept by only measuring what is new, and what would have occurred anyway is not included. This process of determining the incremental increase in value for all outcomes is a more comprehensive method of addressing deadweight than making individual corrections to selected outcomes.

7.5.2 Attribution

Attribution requires values to be corrected to ensure that a benefit is not attributed to the project which should be attributed to others or other unrelated conditions. Outcomes values are based directly on incremental value added as a result of the adaptation and no attribution correction is necessary.

7.5.3 Displacement

Displacement means correcting for a benefit that would have occurred if the adaptation had not been implemented but has now been "displaced". As with deadweight, the delta value determination addresses any displacement, and lost value is included as value lost. Until it is better understood where and exactly what will be implemented as an adaptation, further determination of displacement is not possible.

7.5.4 Drop-Off

Drop-off relates to a decrease in value of benefits over time. This correction does not apply to this comparative analysis in that this is an "instant in time" valuation comparison. Future analysis when applied to specific adaptations may include projections over a specific number of years. In those cases, corrections can be made for drop-off.

7.5.5 Testing Outcomes for Materiality

According to SVI's Principle 4, One of the most important decisions to make is which outcomes to include and exclude from analysis. The basic judgement to make is whether a stakeholder would make a different decision about the activity if a particular piece of information were excluded.

To be most inclusive, all outcomes mentioned by a stakeholder were included. In this analysis, the adaptation was the driver to move forward. However, there may be additional expected outcomes as a result of the adaptation that a stakeholder may not mention but would be applicable. This is common in nature-based adaptations where some outcomes are not immediately evident or obvious. As a result, a traditional materiality analysis is not totally applicable in that the additional outcomes are essentially secondary to the intended activity.

Therefore, for the purposes of this analysis, all outcomes are considered significant and relevant.

The implication of this logic is that all mentioned outcomes went through the process of quantification and valuation. For the Environment stakeholder, the only group that cannot speak for itself, materiality was determined by third-party literature and EcoMetrics LLC subject matter experts.

Figure 6 and Table 12 depict the process of determining materiality. The outcomes of the project were determined by first analyzing collected material from the qualitative phase of research.

Once outcomes were identified by stakeholder group, third-party (secondary source) literature was consulted to validate research findings within broader third-party literature and other relevant studies.

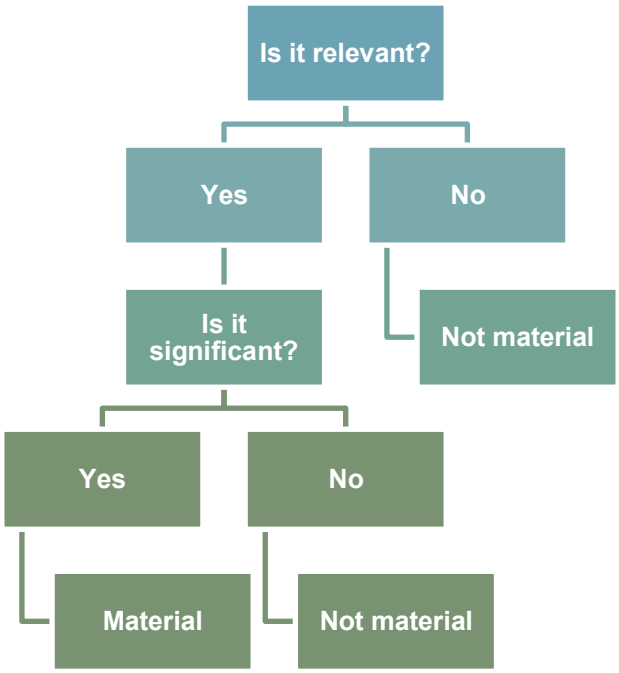

Figure 6: Determining Materiality Through Relevance and Significance

Table 12: Materiality of Outcomes

Stakeholders	Outcome	Was the Outcome Identified by Stakeholders During Qualitative Phase of Research?	Was the Outcome Confirmed by Third Party Research?
Environment	Soil Stabilization	NO	YES
	Soil Formation	NO	YES
	Water Filtration	YES	YES
	Nutrient Cycling	YES	YES
	Biological Control	NO	YES
	Pollinator Population Support	NO	YES
	Habitat and Biodiversity	YES	YES
	Water Regulation	YES	YES
General Public	Aesthetic Value	YES	YES
	Food Provisioning	YES	YES
	Drought Resiliency (for Ag)	YES	YES
	Carbon sequestration- Social Value	YES	YES
	Nitrogen Retention- Social Value	YES	YES

	Phosphorus Retention- Social Value	YES	YES
	Physical Health	YES	YES
	Population Growth	YES	YES
	Enhanced Environmental Flows	YES	YES
	Property Value	YES	YES
Local Economy	Wildfire Risk Reduction	NO	YES
	Agricultural Economy	YES	YES
Government	Water Supply	YES	YES
Recreational Users	General Recreation	YES	YES
Funders	Market Value of Carbon Credits	YES	YES

Where an outcome was not mentioned by a stakeholder but is likely to apply based on technical expertise and prior experience of EcoMetrics LLC, it is noted as "NO" for the stakeholder and "YES" for third party research. This occurs because based on the stakeholder's background and knowledge, especially with nature-based projects, they may not be aware that such a benefit exists.

7.5.6 Unintended or Negative Outcomes

Methodologies were designed to capture unintended consequences or negative outcomes of implementing the adaptations and are depicted as negative values. Other unintended outcomes are described qualitatively in section 6.

7.5.7 Statement of Risks of Overclaiming

The primary approach to avoid overclaiming is to focus the valuation of outcomes only on the incremental component tied to the adaptation being evaluated. In other words, no value is claimed above and beyond what a specific adaptation could provide. There are two primary situations where there is risk of overclaiming:

- Years where due to shortages (drought-related or otherwise), water is not distributed as assumed. For example, a year where water that is intended for agriculture instead gets allocated for municipal growth support. There is no practical way to correct this other than year by year adjustments to the amount of water used for the specified purposes.
- Cases where simultaneous implementation of more than one adaptation in geographic proximity to one another leads to synergistic effects. Each adaptation has been evaluated independently although it is anticipated that two nearby adaptations would have an integrated effect. For example, whereas a number of adaptations could lead to population growth as an incremental percentage increase over current population, the combined population growth of the two co-existing projects could be less than the sum of the individual adaptations by themselves. This happens because the reference from which the incremental value was calculated was based on the entire basin, and not just the immediate area around the adaptation location.

7.6 Analysis of Results

7.6.1 General Points

In order to fully understand the results presented, there are several assumptions and points to note, and an explanation of what is being reflected in the results.

- Each adaptation was reviewed independently. If multiple adaptations are implemented at the same time, especially those that may affect each other, the valuation would need to be corrected to avoid "double counting."
- In the water volume and storage adaptation category, the additional water available was divided among three primary uses- to increase agricultural development, to support municipal growth, and to enhance environmental flows in the rivers. Because each of these uses of water has its own unique set of outcomes, the water volume has to be determined for each. Unless otherwise specified in the option description, it was assumed the water would be distributed evenly among the three.
- EcoMetrics uses publicly available information to obtain quantification and valuation methodologies and proxies. These sources can be project-specific data, peer-reviewed research, credible databases, and verified stakeholder input.
- Valuation of benefits is based on annual recurrence (except property value, which is a one-time valuation). In other words, values presented herein are for a single year but would be expected to recur each year if projected out beyond one year and therefore the results below reflect a conservative view. In reality, the options create much greater value over time.
- It is understood that there is necessary additional investment (capital and operation/maintenance) to realize the various noted outcomes. For this phase of work, that information was not clearly defined for each adaptation and hence outcome values are "total value" created and are not corrected for investment necessary; which would be net value created.
- The environment is considered a stakeholder and therefore environmental attribute value is created. However, this value is realized in an indirect way by other stakeholders. For example, one outcome of better surface water quality is reduced cost of treatment infrastructure for municipalities and more opportunities for recreational users. It is not the environment or ecosystem itself that is being valued; it is the ecosystem service that is provided.
- Some outcomes are qualitative at this point because of difficulty or lack of information to quantify and value. This is particularly true for enhanced environmental flows in that many of the related outcomes are environmental and ecosystem-related and difficult to value. Qualitatively, it is likely that conditions are improved and more resilient, but that impact may not be quantifiable or valued.
- The impact of any given adaptation was related to the basin as a whole. Once the impact of an adaptation can be more defined to a specific area, a more accurate analysis can be used.

Classifying outcomes is not an exact science and there are various choices, but regardless of how sorted, the analysis captures the value of all outcomes.

7.6.2 Adaptations Analysis

The analysis of adaptations creates a significant amount of information. As noted above, the NSRB Roadmap proposes a number of possible adaptations which are anticipated to lead to enhanced water management and address regional water challenges and opportunities. Some of these adaptations lend themselves to an EcoMetrics analysis. Others do not because they are either not developed enough yet as to detail or are for actions that cannot clearly be described in terms of valuing outcomes.

Of the remaining adaptations which are conducive to an EcoMetrics analysis, they can be grouped in a number of "adaptation categories". Adaptations in a given category are similar in terms of how outcomes are defined and valued. For example, a number of adaptations may be variations on increased water use efficiency, or variations of uses for additional water storage. In these cases, the category analysis would be consulted to inform decisions on the various adaptations in the category.

Review of the eligible adaptations, five adaptations categories were defined for EcoMetrics analysis, as follows:

- Adaptations where a specific land cover type could be implemented in lieu of built infrastructure to leverage nature-based solutions to address a water-related challenge.
- Adaptations related to increasing water storage
- Adaptations related to increasing water storage for drought resilience purposes
- Adaptations related to agricultural opportunities
- Adaptations related to increasing water use efficiency (specifically, municipal use)

Sections 7.6.2.1 through 7.6.2.5 below describe each in more detail and provide the valuation of outcomes associated with the adaptation category.

7.6.2.1 Land Cover Types as NBS Adaptation Category

NBS represent a number of approaches and practices that leverage ecosystem services to provide functions in lieu of built infrastructure. Some common NBS approaches include constructed wetlands or riparian buffers along rivers. Unlike built infrastructure that tends to provide a specific role or purpose, NBS adaptations typically provide a suite of benefits thereby significantly increasing the value created per unit investment.

For example, constructed wetlands generate multiple benefits including:

- Soil Stabilization and erosion control
- Water Filtration
- Nutrient Cycling
- Biological Control
- Habitat and Biodiversity
- Genetic Resources
- Medicinal/Ornamental Resources
- Raw Materials
- Cultural and Aesthetic Value
- Air Quality – Other GHG
- Food Provisioning
- Carbon Sequestration
- Nitrogen Retention
- Phosphorus Retention
- Water Supply Resilience
- Storm Flood Protection
- General Recreation

These many benefits affect multiple stakeholders. Which specific outcomes would apply in a particular adaptation implementation will depend on exact land cover type chosen, location, and intended purpose of the implementation.

The EcoMetrics analysis examined four commonly used land cover types as nature-based solutions- forest, riparian buffers, wetlands, and grasslands. Combinations of more than one land cover type are possible, as are other types of land covers. Each land cover type has a unique set of outcomes, and the quantification and valuation methodologies will vary between land cover types. Table 13 represents the per acre (ac) value created for a core list of outcomes associated with each land cover type. Based on details available at the time of the analysis, some outcomes are not applicable for a given land cover type (noted as N/A) and in other cases, a credible and applicable financial proxy was not available.

Results indicate that all of the land cover types provide multiple benefits, with wetlands and forest offering the greatest value per acre. In cases where a proxy is not available, the expectation is that value would be even greater when added.

Table 13: Outcome Values for NBS Land Cover Types (per acre)

Outcomes	Forest ($/ac)	Grassland ($/ac)	Riparian ($/ac)	Wetlands ($/ac)
Aesthetic Value	$1,431	$134	$775	$775
Agricultural Economy	N/A	N/A	N/A	N/A
Biological Control	$33	$45	Unavailable	$225
Carbon Sequestration Social Value	$73	$2	$73	$103
Drought Resiliency	Unavailable	Unavailable	Unavailable	Unavailable
Food Provisioning	N/A	Unavailable	N/A	N/A
Habitat and Biodiversity	$2,868	$425	$1,538	$3,451
Nitrogen Retention Social Value	($36)	($34)	Unavailable	Unavailable
Nutrient Cycling	$15	$15	Unavailable	Unavailable
Phosphorus Retention Social Value	($8)	($16)	$3,444	$3,444
Pollinator Population Support	N/A	$659	N/A	N/A
Property Value	N/A	N/A	N/A	N/A
Soil Formation	$25	$1,155	$151	$893
Soil Stabilization	$301	Unavailable	$301	$2,093
Water Filtration	$974	$974	$974	$974
Water Regulation	$534	Unavailable	$482	$482
Water Supply for Population Growth	$10,406	$204	N/A	$12,682
Wildfire Risk Reduction	N/A	N/A	N/A	N/A
Total Social	**$16,616**	**$3,561**	**$7,739**	**$25,123**
Market Value of Carbon Credits	$38	$1	$38	$54
Total Market	**$38**	**$1**	**$38**	**$54**
Total	**$16,654**	**$3,562**	**$7,777**	**$25,176**

Footnotes:

- Values are rounded up to the nearest dollar
- Values in red and parentheses are negative values, representing value lost or a cost

- N/A means the outcome is not applicable to the land cover type.
- Unavailable means a credible and verifiable proxy value could not be identified in the peer reviewed literature
- $0 means the outcome is not creating measurable value for the land cover type.

7.6.2.2 Water Storage Adaptation Category

For the water storage adaptation, Table 14 reflects the outcomes and corresponding values. In this adaptation category, value of outcomes is based on a per cubic decameter basis (dam3). In the Roadmap, water volume from storage could be used to:

- Support municipal growth (as increased population) based on per person water use
- Enhance environmental flows- as increased volume allowed to remain or be added to waterways
- Provide for agriculture to support acres of agricultural use. Generally speaking, irrigation is not utilized in the NSRB, and acres are based on water available by natural processes and not controlled irrigation. Agriculture is considered a separate adaptation category and described in a dedicated section below.

Value of the *municipal growth* outcome is based on how many people a dam^3 can support in a year, and what the Gross Domestic Product (GDP) per person is, giving an indication of economic productivity associated with each person. GDP/Capita is a composite number reflecting the many different ways a person contributes to the local economy. Provincial values of GDP/Capita and regional water use per person amounts were used to determine the GDP per dam^3. It is possible to dissect the general GDP/Capita number into more specific sub-outcomes, such as tax income, energy production, goods and services, and others. For Roadmap adaptation valuation purposes, that level of granularity is not necessary.

Enhanced environmental flows reflect the benefits associated with more resilient and desired river flows and are challenging to value in terms of per dam^3. This is because specific impacts of more flow in the rivers would need to be defined and quantified such that it can be valued. There are many outcomes associated with environmental flows. For this initial analysis, the quantified benefits related to increased recreational opportunities and physical health of residents. This is an indirect measure of the value of enhanced environmental flows, but based on the literature, are the most logical ways to address the related adaptations. However, it is understood that there are many other benefits such as aquatic ecosystem health and wastewater effluent dilution. These are more difficult to quantify and value with the proxies available currently. Hence, the environmental flows value is a conservative figure that is likely greater in absolute value, which would in turn increase its share of the total value created.

As would be expected, the most significant outcome value created associated with additional water volumes are related to supporting population growth.

Table 14: Outcomes Values for Increased Water Storage (per dam3)-Value Created

Outcomes	Value per dam^3	10,000 dam^3
Enhanced Environmental Flows ($/resident)	$7,281	$22,954,566
General Recreation ($/visitor)	$77	$77
Physical Health ($/visitor)	$809	$809
Population Growth ($/$dam^3$) (9 persons/$dam^3$ and $71,640 of GDP/capita)	$644,760	$2,032,713,360
Total Social	$652,927	$2,055,668,812

7.6.2.3 Water Storage Adaptation Category, Drought Resilience

This adaptation category is based on having water storage to offset shortages due to drought. The EcoMetrics analysis for this category is the same as for water storage (7.6.2.2) but instead of characterizing it as *value created*, it is considered *value preserved*. In other words, had the water not been available, as a result of drought-related shortages, the value would have been lost, at least during the drought period. Table 15 can be the same as Table 14, but with the outcome value characterized as preserved.

Table 15: Outcomes Values for Increased Water Storage (per dam3)-Value Preserved

Outcomes	Value per dam3	10,000 dam^3
Enhanced Environmental Flows ($/resident)	$7,281	$22,954,566
General Recreation ($/visitor)	$77	$77
Physical Health ($/visitor)	$809	$809
Population Growth ($/dam3) (9 persons/dam3 and $71,640 of GDP/capita)	$644,760	$2,032,713,360
Total Social	$652,927	$2,055,668,812

7.6.2.4 Agricultural Opportunities Adaptation Category

A portion of the water in a watershed goes to agriculture. Even in cases where there is no controlled irrigation, water that enters the watershed still gets used by agricultural activities. Agricultural land use has many environmental, economic, and social outcomes, in part because it is so closely linked with the environment and ecosystems. As it is used for economic development, the property value of agricultural land is relevant in a valuation analysis. Unlike other outcome values, this is a one-time value and is not recurring. Table 16 shows value per acre of agricultural land.

Table 16: Outcomes Values for Agricultural Opportunities (per acre)

Outcomes	Value per acre
Aesthetic Value	$95
Agricultural Economy	$1,213
Biological Control	$24
Carbon Sequestration Social Value	$5
Drought Resilience	$78
Food Provisioning	$1,145

Habitat and Biodiversity	$1,823
Nitrogen Retention Social Value	($548)
Nutrient Cycling	$18
Phosphorus Retention Social Value	$324
Pollinator Population Support	$429
Property Value	$4,200
Soil Formation	$4
Soil Stabilization	($252)
Water Filtration	$170
Water Regulation	$11
Water Supply for Population Growth	$0
Wildfire Risk Reduction	$188
Total Social	**$8,926**
Market Value of Carbon Credits	$2
Total Market	**$2**
Total	**$8,929**

7.6.2.5 Enhanced Municipal Water Use Efficiency Adaptation Category

The water use efficiency adaptation category is a subset of the water storage category, but views more water being available as less use per person vs more storage created (Table 17). The value per dam3 is the same as the storage category, except in this case the outcomes are limited to those associated with population growth. The expectation is that with increased water efficiency, a larger population could be supported with the same volume of water as each person is using less. This would apply in the specific scenario where there is limited water availability as well as inability for municipalities to procure additional water licenses. In this scenario, water use efficiency would translate into more water to support population growth, and in turn, create more economic growth (GDP).

Table 17: Outcomes Values for Municipal Water Use Efficiency

Outcomes	Value per dam^3
Enhanced Environmental Flows ($/resident)	$7,281
Population Growth ($/$dam^3$) (9 persons/dam3 and $71,640 of GDP/capita)	$644,760
Total	$652,041

7.7 Sensitivity Analysis

7.7.1 Discount Rate Analysis

When doing a typical predictive EcoMetrics analysis for scenarios that look into the future, sometimes a time horizon is used. This allows the value accumulated over several years to be determined. When this kind of multi-year projection is done, it requires compensation for uncertainty and changes in dollar values. A discount rate analysis can be done to see how net present value varies based on an assumed discount rate. This analysis is often conducted to help

policy makers and project planners understand the future net benefits of an initiative. Particularly with environmental based efforts, the time scale for change is often long. For this comparative analysis, we examined a "snapshot in time" and did not do a multi-year analysis hence a discount rate analysis is not applicable.

7.7.2 Outcome Valuation Sensitivity Analysis

Typically, EcoMetrics will perform a sensitivity analysis on selected outcomes to determine the implication of ranges either on quantification constants and/or financial proxies. However, as the adaptations are still in the early, predictive stages, it is difficult to fully understand all the parameters that would need to be analyzed for sensitivity. Given the uncertainty that any predictive model possesses, it is important to consider the ranges provided for the estimates of value created. For example, some locations may have different proxies than those used herein, or there might be uncertainties in quantification. Once more details and locations are defined for implementation of adaptations, sensitivity analysis can be performed accordingly.

7.8 Limitations

Primary vs Secondary Research

Given the practical constraints of this project, obtaining primary research studies for all the proxies included was not feasible. To provide a robust report given these limitations, extensive research was conducted to apply a range of appropriate social and ecosystem services proxies where direct site-specific and study inputs are not available. The credibility of the sources that are referenced are highly scrutinized, primarily peer reviewed academic journal articles or publications by highly regarded and established organizations such as governments and foundations. Despite the high standards of research, there may always be gaps in research, dynamic and changing landscapes from when the regional research might have been conducted, issues of regional applicability, and other financial and economic factors that may influence the study. In general, the meta-analysis and benefits transfer approach is a widely accepted economic method of valuation, despite its limitations.

Environmental and Economic Systems are Dynamic

It is important to note that both environmental and economic systems are dynamic and can be difficult to predict. Environmental systems can be sensitive to unanticipated climate events, such as droughts, wildfires, and destructive flooding. The aftermath could have a significant impact on the ecosystem services valued.

Stakeholder Data

An increased number and more balanced stakeholder participation across stakeholder groups would offer a more robust analysis of input. Other potential limitations include the stakeholders' understanding of the questionnaire, uncaptured bias, and the comprehensiveness of information collected. It is not always possible to capture important elaboration of feedback or to clarify the objective of the questions asked to ensure proper interpretation of the survey.

Refinement of Current Inputs and Identifying Missing Outcomes

Refinement of current valued outcomes, with the further collaboration of onsite field experts and relevant stakeholder groups, could lead to the integration of more precise data in this

methodology. In addition, further engagement with local experts and stakeholders may identify more outcomes of value than represented here. Secondly, determining costs for implementing the necessary elements to realize the co-benefits valued herein will allow calculation of net value created.

8.0 Conclusions and Recommendations

8.1 Conclusions

This study evaluates the market and non-market value of the environmental, economic, and social benefits of several basin-scale adaptations to water management using the EcoMetrics methodology, which was built on the guiding principles of SVI's SROI Methodology. The SVI approach concerns an in-depth, evidence-based understanding of change for a full range of community stakeholders with recognition of both positive and negative changes as well as intended and unintended outcomes. Value in this context refers in part to the relative importance placed by a stakeholder group on one potential outcome over another. Assigning these valuations using SVI principles requires the use of financial proxies as many of the identified outcomes are difficult to quantify using conventional accounting practices.

As noted in the report, additional water availability by way of adaptations could have a significant impact on the region beyond the stabilization and resilience of water supplies. There are numerous co-benefits associated with the uses of this additional water volume, which bring financial value to a number of stakeholders. In addition, other key findings of the NSRB Roadmap adaptations analysis include:

- Nature-based solutions that leverage different land cover types create value in a number of outcomes, with wetlands being the highest overall value per acre. Water retention is the most productive in terms of value created per outcome.
- Storage options provide value created or preserved mainly through supporting population which generates GDP/capita.
- Increased water available supports agriculture, and agricultural land generates value in a number of outcomes.
- Increased municipal water use efficiency essentially translates into more water to support population growth, which in turn creates more GDP. This would apply in the specific scenario where there is limited water availability as well as inability for municipalities to procure additional water licenses.
- Until more details about adaptations, or details about actual implementation of various adaptations are known, some outcomes can only be valued very generally, if at all. Some outcomes do not apply to all land cover types or all adaptations. To address this lack of information, Not Available is noted. To address the applicability issue, Not Applicable (N/A) is used.

8.2 Recommendations

Based on the analysis and findings, the following actions are recommended:

- *Update and refine the analysis as details of chosen adaptations materialize.* At this early stage, many assumptions were made, and adaptations had to be grouped in more general categories to allow EcoMetrics analysis. As details become available, more refined valuation can be made.
- *Continued stakeholder engagement.* Because each project is unique, application of this work to other sites and situations will require revising and supplementing the stakeholder feedback used herein to ensure other projects are reflecting the appropriate outcomes and proxies.
- *Communicate the impact.* Comparative analysis can be used to communicate the value of implementing the options.
- *Measure the outcomes of specific projects.* Using the results of this analysis, evaluate actual adaptation implementations.

EcoMetrics Analysis Disclaimer

Financial Information

This report represents an analysis of potential benefit value created in accordance with the scope, steps, and caveats explained herein. Even when certified by SVI, this report is not a formal financial analysis that has been reviewed by financial auditors or is aligned with all investment accounting principles. The results are intended to inform business decisions and to help create a business case for possible project investment. For cases where portions of an EcoMetrics report may be used more formally, such as to support carbon sequestration rates for entry into a registry program or a state regulated water quality trading program, other specific methodologies may need to be used and noted accordingly in the report in the applicable sections.

Stakeholder Participation

The EcoMetrics analysis approach relies heavily on the participation of key project stakeholders. Stakeholder participation is completely voluntary, which in turn may not always provide EcoMetrics with a stakeholder group's perspective in its completeness or reflect the opinions of all others in their groups. As EcoMetrics maintains a third party, objective stance in the project, the perspectives presented in this report do not reflect the views or opinions of the authors.

Recommendations Provided

EcoMetrics LLC is a third-party entity that only evaluates project value creation. EcoMetrics is not party to the project or decisions therein. EcoMetrics may assist the client in exploring ways to relate any objective, targets, and indicators to metrics presented in the reports. This would allow capturing in subsequent evaluation updates results of any progress made. EcoMetrics is in no position to enforce or impose these recommendations or strategies and takes no responsibility for the project outcomes or progress.

Appendix I – Workshop Questionnaire

Project Stakeholder Outcome Ranking Exercise

Instructions: There is no right or wrong answer - just rank as you see fit based on your perspective and stakeholder role for this project.

**** please note all responses will be anonymous in the report - names and organizations will not be shared outside of the EcoMetrics team.

Thank you in advance!

* Indicates required question

1. Name *
2. Title *
3. Organization *
4. Primary Stakeholder Group *

Check all that apply.

- ☐ Local government
- ☐ Community stakeholder
- ☐ Education and research
- ☐ Corporation/Private entity
- ☐ Volunteer
- ☐ Employed/contracted by the project
- ☐ Local Business
- ☐ Conservation Group
- ☐ Landowner
- ☐ Indigenous Community
- ☐ Other

Defining Positive Outcomes:

Define the top "headline" outcomes from your perspective (write down no more than 5). If the outcome applies to a specific option of the Road Map, please note that next to the outcome. Your top five outcomes can come from different options.

1.
2.
3.
4.
5.

- **Outcome 1**

  a) How Likely is this Outcome?

  - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

  b) How Beneficial is this Outcome?

  - In YOUR opinion (no right or wrong answer), how beneficial is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not beneficial	◯	◯	◯	◯	◯	Very beneficial

  c) How Widespread?

  - In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

  d) Over what period of time?

  - In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 2**

  a) How Likely is this Outcome?

  - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

  b) How Beneficial is this Outcome?

  - In YOUR opinion (no right or wrong answer), how beneficial is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not beneficial	◯	◯	◯	◯	◯	Very beneficial

  c) How Widespread?

  - In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

  d) Over what period of time?

  - In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 3**

  a) How Likely is this Outcome?

  - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

  b) How Beneficial is this Outcome?

  - In YOUR opinion (no right or wrong answer), how beneficial is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not beneficial	◯	◯	◯	◯	◯	Very beneficial

  c) How Widespread?

  - In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

  d) Over what period of time?

  - In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 4**

  a) How Likely is this Outcome?

  - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

  b) How Beneficial is this Outcome?

  - In YOUR opinion (no right or wrong answer), how beneficial is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not beneficial	◯	◯	◯	◯	◯	Very beneficial

  c) How Widespread?

  - In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

  d) Over what period of time?

  - In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 5**

  a) How Likely is this Outcome?

  - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

  b) How Beneficial is this Outcome?

  - In YOUR opinion (no right or wrong answer), how beneficial is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not beneficial	◯	◯	◯	◯	◯	Very beneficial

  c) How Widespread?

  - In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

  d) Over what period of time?

  - In YOUR opinion how long will it take for this outcome to be experienced?

(you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

Defining Negative Outcomes:

Define any negative outcomes (write down no more than 5)

1.
2.
3.
4.
5.

-
- **Outcome 1**
  a) How Likely is this Outcome?
    - In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

b) How Severe is this Outcome?
    a. In YOUR opinion (no right or wrong answer), how severe is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not severe	◯	◯	◯	◯	◯	Very severe

c) How Widespread?
    a. In YOUR opinion (no right or wrong answer), how widespread will this

outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

d) Over what period of time?

a. In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 2**

a) How Likely is this Outcome?

- In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

b) How Severe is this Outcome?

a. In YOUR opinion (no right or wrong answer), how severe is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not severe	◯	◯	◯	◯	◯	Very severe

c) How Widespread?

a. In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

d) Over what period of time?

a. In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 3**

a) How Likely is this Outcome?

- In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

b) How Severe is this Outcome?

a. In YOUR opinion (no right or wrong answer), how severe is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not severe	◯	◯	◯	◯	◯	Very severe

c) How Widespread?

a. In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

d) Over what period of time?

a. In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 4**

a) How Likely is this Outcome?

- In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

b) How Severe is this Outcome?

a. In YOUR opinion (no right or wrong answer), how severe is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not severe	◯	◯	◯	◯	◯	Very severe

c) How Widespread?

a. In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	◯	◯	◯	◯	◯	Very widespread

d) Over what period of time?

a. In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

- **Outcome 5**

a) How Likely is this Outcome?

- In YOUR opinion (no right or wrong answer), how likely is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not very likely	◯	◯	◯	◯	◯	Very likely

b) How Severe is this Outcome?

a. In YOUR opinion (no right or wrong answer), how severe is this outcome?

Mark only one oval.

	1	2	3	4	5	
Not severe	◯	◯	◯	◯	◯	Very severe

c) How Widespread?

a. In YOUR opinion (no right or wrong answer), how widespread will this outcome be experienced/felt?

Mark only one oval.

	1	2	3	4	5	
Very localized	⬭	⬭	⬭	⬭	⬭	Very widespread

d) Over what period of time?

a. In YOUR opinion how long will it take for this outcome to be experienced? (you can name a specific year or a time range i.e. 1-5 years, 10-15 years, etc.)

Appendix II – Facilitator Guide

EcoMetrics Breakout- Facilitator Guide

November 13, 2024

Discussion Groups

- Today we will be breaking out into working groups with each group facilitated by a WaterSMART leader
- Ed Pinero (EcoMetrics) will roam between the breakout groups to ensure conversation is on track and facilitators receive any needed feedback or guidance
- Each breakout group should have a note taker (may be WaterSMART person)
- There will be a recorder (phone) at each table to make sure we don't miss any key data or talking points. The recordings are for our own internal use, and you will not be directly identified in the EcoMetrics report.
    - *Materials at each table include an Outcome Questionnaire and a project overall impact ranking sheet for each participant*

Breakout Discussion

Introduction to discussion

We will be asking a variety of questions to capture key information related to your role as an information expert and how you place value on the area, proposed activities and potential outcomes as a whole. We will be recording the session and taking notes, but the responses will be **anonymous**. The discussion should take about **60 minutes** (maybe a little more)**.** We are looking for as much detail as possible. This is the kind of breakout discussion, where we are asking about expectations and future impacts of the options in discussion and how these options could impact you as a key stakeholder in the area in the future. You can draw on past experiences with other situations, but we will mainly be talking about expectations. There are no right or wrong answers. Your input will help us determine sense of place, value and expectations from critical information experts related to the area and this project.

Identifying information experts at the table – name, affiliation, etc. **~ 10 minutes**

Please state your name and affiliation. What is your relationship or responsibility in the area? Have you or do you interact with the area if at all as part of your role?

Place-based Relationships **~ 10 minutes**

*****note: if you were able to print basin maps please take place based notes on sticky notes and place them on map location in discussion…Ed will take pictures at the end to capture the notes)*

Please tell us how you are connected to interact with the area or areas included in the options. In other words, why are you a stakeholder?

Establishing the baseline situation **~ 5 minutes**

How do you use or connect to the *areas* now? How does it impact you individually and as a representative of your 'stakeholder' group?

Defining and Ranking Outcomes (to be filled out on printed handout provided) **~ 30 minutes**

First, let's distinguish between outputs and outcomes. For this discussion, in general, the main output is more water available for various uses. In EcoMetrics, ***outcomes*** *are the impact (a benefit if impact is*

positive) that affects stakeholders as a result of the output (i.e. more or less water available in the area as a result of an intervention is an output).

*Using Form Part 1 Outcome Ranking Exercise; what **outcomes** (impacts) do you expect? i.e. as a result of more water what could it benefit? – more supply for community growth, more water supply for agriculture, etc.* With this in mind, Define the top "headline" outcomes from your perspective (write down no more than 5). ** Please note that there is no right or wrong answer – go with your gut response.

If the outcome applies to a specific option of the Roadmap, please note that next to the outcome.

- *Please note to participants there is a section for listing positive outcomes and a separate section for negative outcomes*

Defining and Ranking Overall Environmental, Economic, and Social Impact (to be filled out on printed handout provided) **10 minutes**

Once done with that part, using Form Part 2, we will finish by giving a general ranking for the overall environmental, economic, and social impact of the overall project.

We have a tight timeframe for this breakout and might not have time to do the following.

Additional discussion once forms are completed:

What were some of the most significant outcomes you addressed (positive or negative), and are there any you would like to share or discuss with the group?

Considering the various kinds of outcomes, what do you think the most direct outcome will be for you or your organization?

Additional Discussion **~ 10 minutes**

What do you think are the options that should be prioritized?

- What impacts would these activities have for you, your organization, the community?
- What are the ideal outcomes from your perspective?
- What are the ideal outcomes for the local community?

Wrap Up Questions (if time permits)

- Do you have any recommendations for managing the project in the future?
- How best do you think we can use the information we discussed today?

FINALLY -

IS THERE SOMEONE ELSE WE SHOULD WE TALKING TO? ARE THERE ANY STAKEHOLDERS YOU SEE MISSING TODAY?

Appendix III – Financial Proxies and Reference Citations for Outcomes

Land Use	Non-Acre Dependent Proxy	Agriculture Developed	Forest	Grassland	Reservoir	Riparian	Wetlands
Carbon Sequestration Rate tons/acre/year		0.06	0.95	0.02		0.95	1.34
Erosion Rates tons/acre/year							
Nitrogen Retention Rates lbs/acre/year		-32	-17.8	-16.9	313	312	312
Phosphorous Retention Rates lbs/acre/year		6.7	-0.17	-0.332		71.25	71.25
Aesthetic Value $/visitor/year		94.76	1,430.50	134.36		775.3	775.3
Agricultural Economy $/acre/year		1,213					
Biological Control $/acre/year		24	33.27	44.67			224.77
Carbon Sequestration Social Value $/ton		77	77	77	77	77	77
Drought Resiliency $/farm/year		78					
Enhanced Environmental Flows $/resident/year	809						
Food Provisioning $/acre/year		1,145					
General Recreation $/visitor/year	77						
Habitat and Biodiversity $/acre/year		1,823.40	2,868.40	424.5		1,538	3,451
Nitrogen Retention Social Value $/lb		17.13	2.03	2.03	14.47		
Nutrient Cycling $/acre/year		17.6	15	15			

Phosphorus Retention Social Value $/lb		48.34	48.34	48.34	48.34	48.34	48.34
Physical Health $/visitor/year	809						
Pollinator Population Support $/acre/year		429.08		659			
Population Growth $GDP/capita	71,640						
Property Value $/acre/year		4,200					
Soil Formation $/acre/year		4.12	24.88	1,154.60		151.2	892.7
Soil Stabilization $/acre/year		-251.82				301	2,093
Water Filtration $/acre/year		169.72	974	974		974	974
Water Regulation $/acre/year		11.28	534.27			482.31	482.31
Water Supply $/acre/year			10,406	203.85			12,682.32
Wildfire Risk Reduction $/acre/year		188					
Market Value of Carbon Credits $/ton/year		40	40	40	40	40	40

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