ECOMETRICS ANALYSIS REPORT: SSROM ROAD MAP OPTIONS ANALYSIS

PREPARED FOR: WATERSMART SOLUTIONS LTD

Alberta, Canada

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1.0 Executive Summary

This report contains the EcoMetrics methodology analysis of ten increased water availability options being considered in the South Saskatchewan River Basin (SSRB) as part of a strategic road map for growth in the region. EcoMetrics LLC is the organization that manages the methodology of the same name, was retained by WaterSMART Solutions of Alberta, Canada (WSS) to do the analysis as a component of their more comprehensive study in developing the road map and corresponding report.

This EcoMetrics analysis report incorporates by reference the SSROM Phase 3: Assessment of Strategic Management Projects to Support Economic Growth (SSROM Phase 3) Final Report (WaterSMART Solutions, 2024) and the details of the broader Road Map are not repeated herein. The EcoMetrics analysis component was to evaluate selected options to identify, quantify, and value, in monetary terms, the co-benefits above and beyond the direct benefit of increased water availability. In other words, more available water can be used, which in turn creates benefits.

The ten options that have been evaluated are (listed in alphabetical order below):

- Ardley
- Belly River
- Dickson Dam
- Eyremore
- Increased Flows Past Lethbridge
- Kananaskis Dam
- Spray Lakes Reservoir
- Upstream Bow
- Waterton – St. Mary's Canal
- Western Irrigation District (WID) Off-stream Storage

Most of the options consist of storage expansions and operational improvements. Storage expansions include infrastructure projects to create or expand reservoirs. The overall Road Map is to develop and implement a plan to create additional water availability to the region by enhancing storage and conveyance. Specifics vary from option to option, but in general the intent is to use the water to build regional resilience reduce risk and shortages as well as support growth through increased agricultural irrigation, supporting municipal growth, and enhancing environmental flow in the rivers.

The analysis is from a comparative and predictive perspective. Each option was analyzed individually to determine what impacts would occur in the future if implemented. In order to do this type of analysis, numerous assumptions had to be made (as described below), however assumptions were applied consistently across all options to allow more accurate comparison. Because each option was analyzed independently, likely synergistic effects where more than one option is implemented in proximity to each other or in the same sub-basin would need to be accounted for in future analysis.

For consistency of terminology used in this report, the "outcomes" are the impacts to the region and stakeholders resulting from implementation of an option(s). If the outcome is positive in terms of creating incremental value, then it is a "benefit." In the report, benefit is used

interchangeably with outcome, but with the understanding that there are cases where an outcome has a negative impact and results in loss of value (for example, flooded agricultural land no longer usable for production). These are reflected as negative values in this report.

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 inequality and 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 SROI methodology, project approach, the objectives and activities of the options, and the key findings and assumptions made when completing the analysis. Finally, this report includes a discussion of the SROI results and recommendations.

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. EcoMetrics identifies, quantifies, and values environmental, economic, and social benefits and aligns with the guiding principles of Social Value International's (SVI) Social Return on Investment (SROI) Methodology. The major stakeholder groups that would benefit include:

- The Environment (ecosystems, habitats, ecosystem services)
- General Public
- Local Economy (businesses, tax base, etc.)
- Local Government
- Recreational Users (tourists, visitors, and residents that sightsee, camp, fish, etc.)
- Producers (Farmers that produce goods from newly irrigated acreage)

Table 1 is a high-level summary of the total value created, sorted by stakeholder group, for each analyzed option for a single year. The detail as to how these values were determined are explained in this report. The findings revealed that overwhelmingly, the increased water availability of all the options will have a positive impact in terms of creating value through co-benefits. Value is created by not only the construction aspects of building the options (where applicable), but also through the follow-on effects of using the increased water availability.

Table 1: Values by Stakeholder - All Options Summary

Stakeholder Group	Total Environment	Total General Public	Total Local Economy	Total Local Government	Total Recreational Users	Total Producers	Total Value
Ardley	$159,841,886	$1,851,641,001	$1,952,799,509	$253,818	$2,648,800	$5,886,547	**$3,973,071,561**
Belly River	$18,785,443	$417,090,117	$375,895,915	$29,830	$1,324,400	$691,817	**$813,817,521**
Dickson Dam	$11,636,521	$569,032,530	$12,943,839	$18,478	$2,648,800	$428,542	**$596,708,709**
Eyremore	$173,118,275	$3,107,168,691	$1,967,567,450	$274,900.00	$2,648,800	$6,375,481	**$5,257,153,597**
Increased Flows Past Lethbridge	-	$254,515,923	-	-	$1,324,400	-	**$255,840,323**
Kananaskis Dam	-	$1,608,957,300	$367,000,000	-	$2,648,800	-	**$1,978,606,100**
Spray Lakes Reservoirs	-	$1,608,957,300	$148,000,000	-	$2,648,800	-	**$1,759,606,100**
Upstream Bow	$50,910,250	$1,634,908,080	$1,294,218,531	$80,842	$2,648,800	$1,874,888	**$2,920,061,437**
Waterton - St. Mary's Canal	$13,091,243	$113,295,083	$168,561,994	$20,788	-	$482,115	**$295,451,224**
WID Offstream Storage	$31,854,015	$275,673,076	$128,432,691	$50,582	-	$1,173,098	**$437,183,461**

Valuation of specific benefits (except the Construction elements and Agriculture Developed-Property Value) is based on annual recurrence. In other words, values presented herein are for a single representative year, but some benefits values would be expected to recur each year if projected out beyond one year and therefore the results reflect a conservative view. In reality, the options create much greater value over time.

2.0 Project Background

2.1 Background and Area Description

As described in the SSROM Phase 3: Assessment of Strategic Management Projects to Support Economic Growth (SSROM Phase 3) Final Report (WaterSMART Solutions, 2024):

"*The SSRB is vital for Alberta's environmental, social, and economic prosperity. This river basin supports municipalities, manufacturers, tourism, resource extraction, and agriculture. The SSRB encompasses four subbasins: the Bow River, the Oldman River, the Red Deer River, and the South Saskatchewan River subbasin. In total, the SSRB covers an area of 112,000 km^2 and supports approximately 1.8 million Albertans (Red Deer River Watershed Alliance, 2023; Oldman Watershed Council, 2022; Bow River Basin Concil, 2023). Water utilization within the SSRB is carefully managed to guarantee the fulfillment of water requirements while upholding the ecological well-being of the basin. Attaining sustainable population expansion and economic progress in the SSRB mandates a delicate equilibrium be maintained to balance between people's needs and those of the environment, all within the scope of a shifting climate. It is imperative for water users, managers, and decision-makers to understand how development decisions affect water accessibility and identify opportunities to enhance water governance throughout the basin.*"

As part of the assessment of these projects, understanding the additional value created by the co-benefits resulting from implementation is of interest to make more informed decisions. The determination of potential benefits was based on:

1. the intended use of the additionally available water for municipal growth support as population grows,
2. increased agricultural production by adding more irrigated acres, and
3. by stabilizing environmental flows in the rivers to support ecosystems and recreational uses.

The three potential use categories were based on key objectives and understandings of the Road Map. First and foremost was the importance of stable and resilient water availability supported by sound and sustainable water management. For a region historically plagued by shortages and limitations on growth due to limited water availability, this strategy is paramount for future success.

Second, was understanding that the intended use categories applied in the EcoMetrics analysis was based on the fact that to meet the overall strategy goals, the increased availability would be used to support those three main uses. Hence, EcoMetrics LLC based the identification and categorization of outcomes as resulting from one or more of these three intended uses. These outcomes would be above and beyond the core outcomes of stabilizing river flows and addressing shortages, which would take priority for use of the additional water availability. In other words, if the additional water is not used for addressing shortages or addressing river flows, then it would be used as noted above which would create the outcomes.

As explained in the WSS 2024 report, a significant effort was put into modeling the SSRB study area to determine how much additional water could be available, where specifically, and when. This comprehensive modeling helped EcoMetrics determine the value of benefits as many of the changes would be based on additional water volumes. Section 7 explains how EcoMetrics translates water volume into other metrics that allow for specific outcome quantification and valuation.

EcoMetrics LLC obtained the majority of the information regarding the options being considered from WSS, and via several resource documents, including reports on prior Road Map phases. A number of assumptions were necessary in order to provide quantified values for benefits at this stage, and those are described in detail in Section 7.

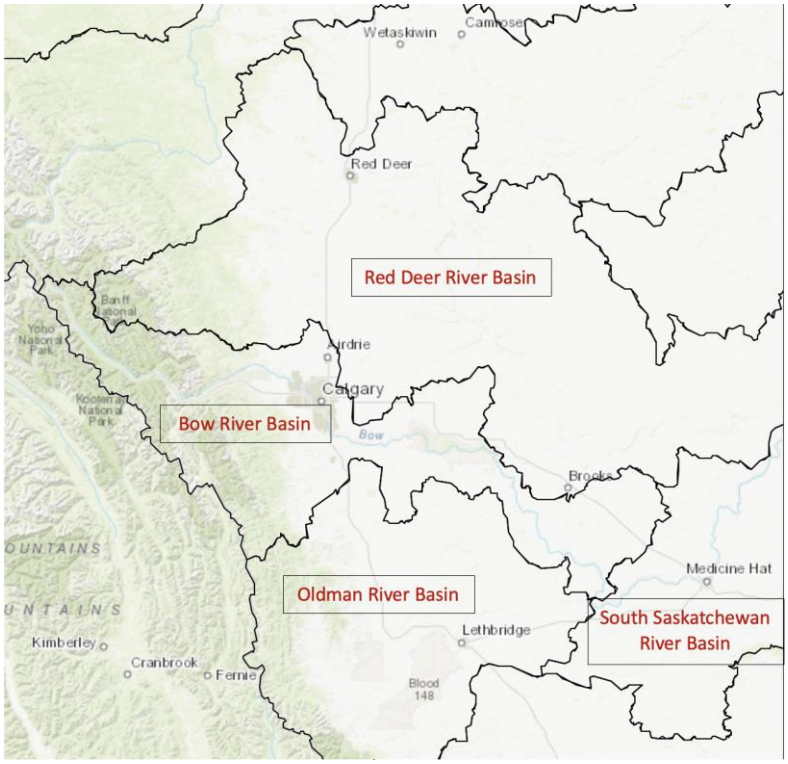

Figure 1: Location Map

3.0 Benefits Valuation Background

3.1 Purpose and Approach of Benefits Valuation

The EcoMetrics methodology identifies, quantifies, and values (in monetary terms) the social, economic, and environmental outcomes resulting from investing in nature-based solutions. The model combines quantitative and qualitative values across numerous social, economic, and environmental categories to forecast the relative values of social and economic outcomes, understanding that there are assumptions and uncertainty associated with such forecasts. The EcoMetrics methodology aligns with the guiding principles of Social Value International's (SVI) Social Return on Investment (SROI) Methodology.

In other words, there are inputs (financial, human, other) necessary to do an activity. The activity creates outputs, which in turn causes changes that impact stakeholders (outcomes). For this project, an input would be investment in construction for expansion of a reservoir. The output is more water available. An outcome would be more food produced as a result of the increase in irrigated land from more available water.

The SVI approach is an in-depth, evidence-based understanding of change for a full range of relevant stakeholders. The approach recognizes that as a result of these changes, both positive and negative changes as well as intended and unintended outcomes will occur. The valuation in the context of SVI refers to the monetary value associated with the relative importance placed by

a stakeholder group on one potential outcome over another. Assigning these valuations using SVI principles requires the use of a financial proxy, or a monetary amount per unit of the outcome, as many of the identified outcomes are difficult to quantify using conventional accounting practices.

The objectives of this project were to use the SROI methodology to:

- Identify and engage relevant key stakeholders affected by the increase in water availability – Understand what each stakeholder wants changed (objectives), what they contribute (inputs), what activities they do (outputs) and what changes for them (outcomes, intended or unintended) as a result of their involvement;
- Measure and value the impacts of the options – 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 options – Articulate the key drivers of value creation and identify what data are needed to best measure and evaluate the impacts of activities.

To fully measure and evaluate the impacts of the proposed options, this research incorporates scientific data on the objective impacts into the SROI evaluation. These data are directly tied to the outcomes defined by the key stakeholders and used to quantify the value of environmental, economic, and social change. The reference to social value is because of the connection to stakeholder input, although it is understood that stakeholders are affected by environmental and economic outcomes as well as social outcomes. The SROI methodology presents these social values in terms of financial equivalents, which allows stakeholders across the board to evaluate the cost/benefit favorability or unfavorability of proposed environmental interventions. Such valuation of outcomes will allow others to understand the internalized financial benefits and externalized societal benefits of making investments in nature-based solutions.

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

3.2 Social Return on Investment (SROI) Approach

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 inequality and 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.

There are two types of SROI analysis:

- Forecast, which is designed to understand and predict the desired impact and outcomes of an activity for significant stakeholders.

- Evaluative, which is conducted to set the baseline and/or retrospectively to validate a forecast or baseline SROI to understand if the impact sought was achieved.

Forecast SROIs are especially useful in the planning stages of an activity. They can help show how investment can maximize social impact and are also useful for identifying what should be measured once the project is implemented (SROI Network, 2012). For this project, the EcoMetrics methodology was used to predict the value created by a number of options and is described in detail in subsequent sections of this report.

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 this 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 in order 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 SROI process works 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 2):

Table 2: 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

SROI puts a value on the changes that take place as a result of the activity and looks at the returns to those who contribute to creating the change and others who benefit from it. It estimates the return on investment or the value for this change and compares this value to the investment required to achieve that impact. It takes standard measures of economic return a step further by placing a monetary value on social returns (Social Ventures Australia, 2011). In this context, social return includes environmental and economic returns as well. The development of an impact map demonstrating the impact value chain for each stakeholder group is critical to this process. This impact map is described in Section 5. It links stakeholders' objectives to inputs (e.g., what has been invested), to outputs (e.g., increase in water availability), through to the outcomes (e.g., increase in irrigated agricultural land). The process then involves identifying indicators for the outcomes, so that we can measure if the outcome has been achieved. The next step is to use financial proxies to value the outcome.

It is then necessary to establish the amount of impact each outcome has had. Impact is defined in the SROI as an estimate of how much of the outcome would have happened without the project and the proportion of the outcome that can be isolated as being added by the activities being analyzed. A number of filters are utilized in the analysis to render additional validity and stability to the conversion of non-market social values into their financial equivalents. SROI uses four filters applied to each outcome to establish the impact of the activities. Not all corrections apply in all projects. Further explanation is provided in Section 7.5.

- Deadweight – What would have happened anyway?
- Displacement – Were other existing outcomes displaced to create the outcome?
- Attribution – Who else contributed to the outcome beyond those who funded and own the project?
- Drop-off – How much does the outcome drop-off each year?

Establishing impact is important as it reduces the risk of over-claiming and may also help identify any important stakeholders that may not have been included in the initial analysis.

2.2.1 SVI Certification

SVI provides an option where the entire work product is independently reviewed, and assurance and verification provided as 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 useful in that it focuses on the socio-economic valuation and validates that stakeholder engagement was robust and appropriate. At the time of the writing of this report, in consultation with others including EcoMetrics, LLC, SVI is refining how they view nature-based solutions projects in terms of their certification requirements.

3.3 SROI Stages

The EcoMetrics analysis is done in six stages. These stages and the activities completed in each of them are listed below:

1. Establish scope and identify stakeholders

    a. Define boundaries and time scale for analysis
    b. Define stakeholders
2. Map outcomes
    a. Engage with stakeholders to develop a preliminary impact map that shows the relationship between objectives, inputs, outputs and benefits/outcomes
3. Evidence outcomes and give them a value
    a. Synthesize data from stakeholder engagement into a virtual impact map
    b. Identify relevant indicators and financial proxies to monetize the benefits, where possible
    c. Define the investment, both direct cash investments and pro bono contributions from the various stakeholders
    d. Conduct follow up interviews to verify evidence where required
    e. Test assumptions with key relevant stakeholders
4. Establish impact
    a. Determine those aspects of change that would have happened anyway or are a result of other factors
5. Calculate the benefits' value
    a. Populate and use the EcoMetrics platform to sum the benefits, subtract any negatives and compare the result to the investment. This is also where the sensitivity of the results is tested as necessary.
6. Report, use and embed
    a. Prepare a detailed report which describes the methodology, assumptions made, results and recommendations
    b. Complete summaries of the SROI analysis
    c. Report to stakeholders, communicate and use the results, and embed the SROI process in the organization

3.4 Unique Aspects of Applying the SROI Methodology to Nature-Based Solutions

Nature-based solutions, including those associated with preserving, conserving, and restoring natural settings and land covers, introduce the concept of ecosystem services-related benefits. An ecosystem service is simply a positive impact or benefit that nature provides to society. These can be direct or indirect and fall into a number of categories. For example, a direct service is the natural surface water filtration by wetlands or the carbon sequestration capacity of vegetation. An indirect service is recreational value or overall well-being.

In general, and for the purposes of this analysis, ecosystem services, green infrastructure, and other ways to leverage nature and natural resources are collectively referred to as nature-based solutions. Recognizing the benefits associated with nature-based solutions allows us to quantify and value those benefits, demonstrating that protecting such areas actually does create and preserve value. The valuation also allows comparison between nature-based solutions and more traditional built infrastructure.

Efforts with environmental and nature-based solutions attributes are different than typical SROI-related projects. Benefits tend to focus on changes to the environment and natural ecosystems, which in turn have impact and provide benefits to a variety of stakeholders. Applying the SROI

methodology to environmental projects, however, poses unique challenges. The SROI methodology has historically been used by community organizations focused on social welfare programs which have a clearly defined period of investment and an associated commensurate period of benefits (Social Ventures Australia Consulting, 2011). With nature-based solution environmental projects, many of the benefits are often not readily or immediately apparent to stakeholders. For example, the assignment of carbon, nitrogen, and phosphorus offset credits provides direct benefits to the funders and partners. However, the environmental value of carbon, nitrogen, and phosphorus for other stakeholders and society at large are generally not identified as outcomes through stakeholder engagement.

To account for these more intangible benefits, the environment is considered as 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. The results of this research can be considered outcomes that will accrue to various stakeholder groups in the future. However, environmental benefits also have ancillary benefits to other stakeholders and those are noted and accounted for herein. These ancillary benefits can include improved health due to cleaner air and water or enjoyment of increased biodiversity.

As noted in the description of the methodology, stakeholder engagement is a fundamental element in that outcome are defined, quantified, and valued in parge part due to their feedback and insight about perceived and expected changes. Section 4 describes the process for engagement, Section 5 then maps expected changes by stakeholder group, followed by Section 6 which describes what stakeholder noted in the context of expected outcomes.

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. As a result of longstanding work under a collaborative lens, WSS has created lasting relationships with key basin and sub-basin stakeholders in the SSRB. WSS was founded in 2004 with the mission to improve water management in the province through better practices, solutions and technologies for the economic, environmental and social benefit of current and future generations. Through project development and execution, collaboration and communication and water strategy and implementation, WSS seeks to provide collaborative, action-oriented solutions to address water needs and related adaptive management strategies for water supply in the province and beyond.

The EcoMetrics analysis of the proposed options was done in the broader context of the Road Map 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 projects in the basin, EcoMetrics LLC utilized these existing contacts and the existing SSRB Road Map 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 Road Map for Sustainable Water Management in the SSRB process to inform water management decisions and identify project opportunities to enhance, adapt and sustain Alberta's water supply in the SSRB into the future. Because of the large scale and wide geographic expanse of the potential impacts from the options, stakeholder categories tend to be relatively generalized.

Table 3: Stakeholder groups and numbers of represented stakeholders

Stakeholder Group	Number
Municipalities	11
Government of Alberta	10
Irrigation Districts and WPACs	7
NGO	7
Indigenous	3
Industry	2
Total	40

Table 3 and Figure 2 below show the distribution of stakeholder types in the Road Map Working Group. Table 3 is specifically that subset of the Working Group that participated in the EcoMetrics stakeholder engagement process.

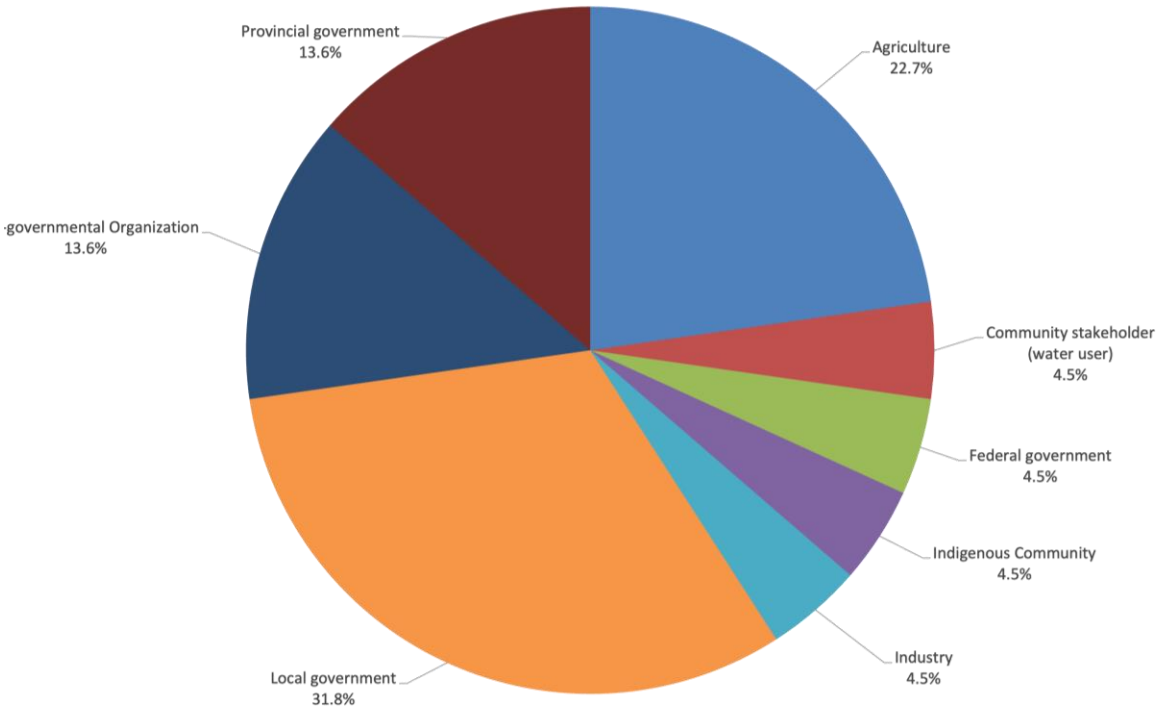

Figure 2: Stakeholder representation proportions of Road Map Working Group

4.1.1 Description of Stakeholder Groups

General Public

As the climate continues to change, 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 depend 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. For this analysis, the General Public stakeholder group also includes a number of non-governmental organizations representing environmental interests, local communities, and specific economic sectors (e.g., Cattlemen's Association).

Local Economy

The local economy is a subset of the general public, but this category is focused on the economic aspects of outcomes related to the proposed options. This includes the economic development impacts of agriculture, tourism, recreation, and population growth. Stakeholders representing the local economy span regional industries including agri-producers, but also others such as economic development authorities, irrigation districts, utilities and power generation, and other stakeholders representing private companies or industry.

Local Government

Proper management and protection of the environment are of interest to a number of provincial 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. From a policy perspective, Irrigation Districts are also local governance.

Recreational Users

The SSRB is not only a powerhouse for water resources shared by water users, municipalities, producers, and industry, but also 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 SSRB watershed and all the related ecosystem services. Several provincial parks and part of a national park are included in the study area.

Producers

Agriculture and agri-related industries are one of the largest economic drivers in the province of Alberta. Historically, Alberta has functioned as a breadbasket for the province and the country. With significant population growth projected in Alberta, Saskatchewan and throughout Canada, there is a growing need to expand agricultural production in the province. As a result, agriculture and agri-food sectors have been identified as one of the major areas for growth and investment.

These increasing demands on agricultural producers have resulted in increased demand on shared water resources in the province and the SSRB. The province endeavors to boost its agriculture and agri-food sectors by leveraging water resources through innovative adaptive management practices. The agricultural producers were a key stakeholder group in light of the intended directed use of increased water availability for expanded irrigation.

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.

4.2 Outreach Strategies

With consideration of the long-term stakeholder engagement led by the WSS team to date, EcoMetrics LLC determined it was useful to tap into existing WSS SSRB stakeholder workshops to meet with and interview key basin stakeholders. Using a pre-approved interview guide aligned with Social Value International (SVI) principles, stakeholder engagement involved mixed qualitative and quantitative questions 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

EcoMetrics conducted its stakeholder engagement in conjunction with a WSS-hosted SSRB Road Map Working Group workshop that was held on October 13, 2023, at the University of Calgary in Calgary, Alberta. The workshop hosted 40 attendees ranging from the identified stakeholder groups:

- General Public
- Local Economy
- Local Government
- Recreational Users
- Producers
- Environment

The workshop attendees were separated into 4 different working groups, 3 on-site working groups organized by river sub basins (Old Man River, Bow River and Red Deer River) and an online working group of online attendees spanning the whole basin. Each working group was moderated by a WSS or EcoMetrics representative. The working groups were guided through a series of questions derived from a Facilitator's Guide provided by EcoMetrics staff (Appendix 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 projects or interventions proposed. To tease out these outcomes, stakeholders were provided with an Outcome Form (Appendix II) to assist them in identifying and ranking various positive and/or negative outcomes they could envision with the proposed actions in each Basin.

Because many of the WPACs were not in attendance at the October 13th workshop, WSS held a separate call with them on October 27th to brief them on the main workshop highlights; but this was not an EcoMetrics engagement session. However, in the general discussion EcoMetrics LLC did glean some insights from the WPACs on expected impacts from the options.

In addition, EcoMetrics LLC briefed a subset of the Working Group on December 18th who were interested in a deep dive into the preliminary valuation of outcomes results. Additional insight on how to view the outcomes was obtained in the discussion and is reflected in Section 7.

Table 4: Dates of Outreach and Engagement Activities

Date	Activity	Location (if applicable)	Parties Involved
October 13, 2023	Stakeholder Workshop	University of Calgary, Calgary Alberta and Zoom	WSS, EcoMetrics, SSRB Road Map Working Group
October 27, 2023	Workshop briefing for SSRB WPACs	Zoom	WSS, SSRB WPACs, EcoMetrics
December 7th, 2023	Working Group Meeting	University of Calgary, Calgary Alberta and Zoom	SSRB Road Map Working Group
December 18th, 2023	Working Group call	Zoom	Some members of the Working Group, WaterSMART Solutions, and EcoMetrics LLC

4.2.3 Ranking Survey

As part the data collection process, all stakeholders identified by WSS were sent a Google Form format of our stakeholder ranking exercise survey to record value rating responses assessing the current and future scenarios in the basin. EcoMetrics inquired into the current and past use of the area; the environmental/ecological footprint of the area; the historical significance of the area; the possible activities that will occur and what kind of impacts this might bring to the area and how the area fits into an existing landscape of ecological functions and management. The specifics of what was asked in the survey are provided in Appendix I. Out of the 85 stakeholders this form was sent to via email, EcoMetrics received 22 responses. A second survey was used with the 40 attendees of the workshop on October 13th. That survey form is provided as Appendix II. Results of the survey are discussed in Section 6.

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, 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 5: 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 ag-related enhancements	Enhanced environmental conditions	Restored, preserved, conserved areas, biodiversity, and wildlife linkages
Local Economy	Labor, purchasing of goods and services	Stronger ag economy, support population growth, tourism and recreation economy	Positive return on investment	Economic development growth
General Public	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
Producers	Labor and capital investment	More water to increase irrigation to lead to better agricultural opportunities, more sustainable regenerative practices	More agricultural production	Value of production of crops and other goods
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 October 13, 2023, and additional information gathered during a October 27, 2023 Zoom with key stakeholders.

Stakeholder engagement was conducted as part of the EcoMetrics analysis of the project to better understand anticipated outcomes of interest or concern for each stakeholder group. To achieve this input, EcoMetrics interviewed groups of stakeholders during the organized workshop. 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.

The workshop attendees interviewed were separated into 4 different working groups (3 onsite at the University of Calgary and 1 on Zoom for remote participants). In total 40 stakeholders were interviewed through the working group process.

EcoMetrics uses a set of questions designed to learn from stakeholders how they perceive the change from prior or current conditions and what they expect from the proposed projects and which they think will have the greatest beneficial impact on the subbasins and SSRB overall. (Appendix II). This questioning is intended to learn what impacts are expected from the proposed projects and what those impacts would mean to the specific stakeholder group. Where possible, we 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

The following ten projects identified by WSS were reviewed for EcoMetrics valuation:

1. Implement releases for downstream water demands at Dickson Dam
2. Build upstream water storage on the Bow River
3. Build new on-stream water storage on the Red Deer River (Ardley Reservoir)
4. Increase minimum flows past Lethbridge to improve effluent dilution
5. Improve spillway capacities on Kananaskis Dam to increase available water storage
6. Restore Spray Lake Reservoir to its full supply level
7. Remove canal bottleneck between Waterton and St. Mary Canal
8. Build new on-stream water storage on the Bow River (Eyremore Reservoir)
9. Build new on-stream water storage on the upper Belly River (Upper Belly River Reservoir)
10. Build new Western Irrigation District Water Storage

All shared common themes:

- Increased irrigation for enhanced agriculture
- Water supply for growing populations
- Flood control
- Environmental flows

General Public

The general public stakeholders benefit the most from each project in a variety of ways. Those projects which will improve water supply, flood control and environmental flows will have the most direct impact on the general public by impacting their health, well-being and livelihood, and sustaining current and growing populations. Indirectly, the projects which increase irrigation for enhanced agriculture 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 perceived the projects of greatest benefit to be those which improved water capacity and mitigated future water supply risks in the face of a changing climate. Projects 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 increased irrigation will expand the economic development 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.

Local Government

In reviewing the project options 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 noted that any project which enhanced or sustain 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.

Recreational Users

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. Reservoirs create lakes that are used for many types of recreation such as picnicking and boating. One concern highlighted was the potential impact of construction, flooding (to create reservoirs), or disruptions to existing water flow on aquatic species and habitat and movement within the riverine systems.

Producers

Stakeholders interviewed in agri-related industries and producer groups highlighted the importance of projects which increase irrigation for enhanced agricultural production. By prioritizing projects which improved access to water supplies for irrigation, producers believed that the other beneficial outcomes would be realized – i.e. supporting growing populations, drought resilience, food provisioning, nutrient cycling, soil formation and stabilization, and carbon sequestration.

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.

6.2 Quantitative Analysis of Stakeholder Input Data

In order to better understand the data provided by the stakeholders engaged in this effort, select statistical analyses were performed. In the analyses, 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.

For one survey (pre-workshop survey) respondents were asked to rank outcomes from the options using a 1 to 5 rating for the categories of Economic, Cultural/Social, Education/Research, Ecological/Environmental, and Community Enhancement.

In the subsequent workshop breakout session survey, stakeholders were then 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.

6.2.1 Pre-Workshop Survey Results

As noted in section 4, prior to the stakeholder engagement workshop of October 13th, attendees were asked to complete a survey to get a general sense of their expectations of impacts stemming from implementation of the options. The purpose of the pre-workshop survey was to:

- Begin the process of identifying current and expected impact of the proposed options.
- Allow for some degree of quantification of priorities and level of importance.
- Serve as inputs for the October 13, 2023, breakout discussions.
- Help guide the EcoMetrics analysis.

There were 22 responses out of 85 members across several stakeholder groups, however the stakeholder type response percentages were not fully aligned with the working group profile (Figure 3).

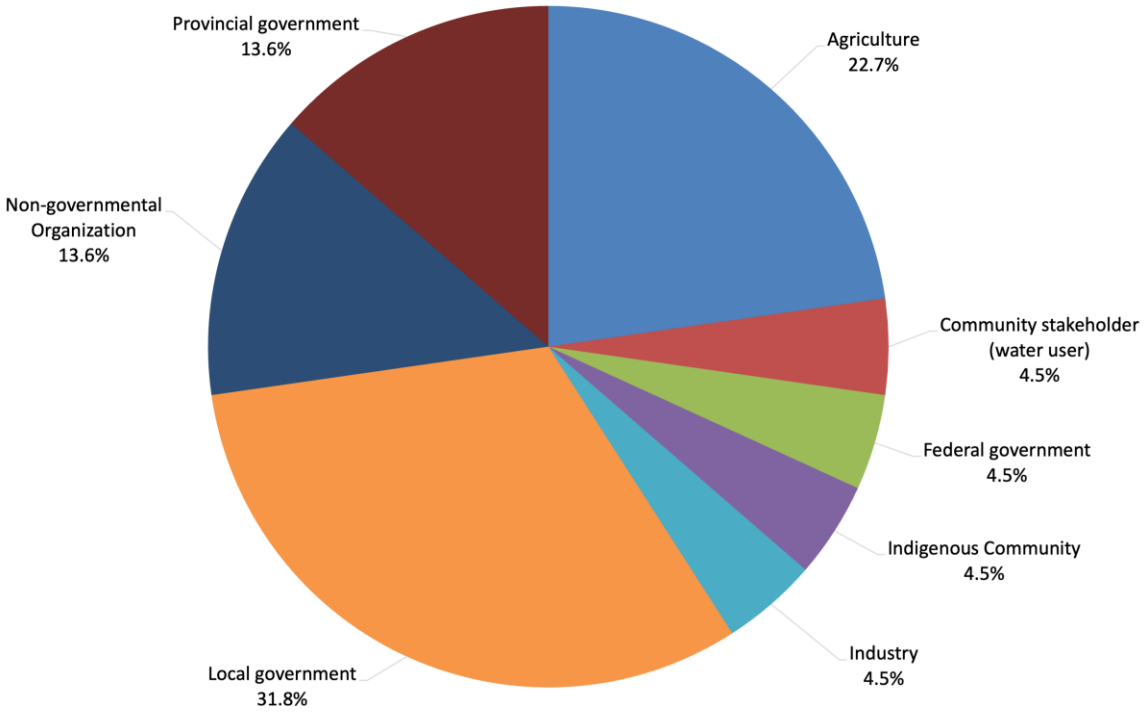

Figure 3: Pre-Workshop Survey Responses by Stakeholder Type

In terms of ranking of the offered categories, Environmental/Ecological and Community Enhancement received the highest average, with Cultural/Societal getting the lowest, however all were statistically close.

In terms of specific options, several scored higher than baseline but other than Spray Lakes and Belly River, all scores were relatively close, with Bow River Irrigation District Diversion Rate, Canal Optimization of Waterton St. Mary's, and Stormwater Use Water/Reuse, all topping the list.

6.2.2 Workshop Breakout Session Results

A different survey was used for the breakout session participants where more specificity was requested regarding expected outcomes and asking respondents to rank the outcomes as compared to outcomes categories (Appendix II). The distribution of stakeholder types for results is depicted in Figure 4.

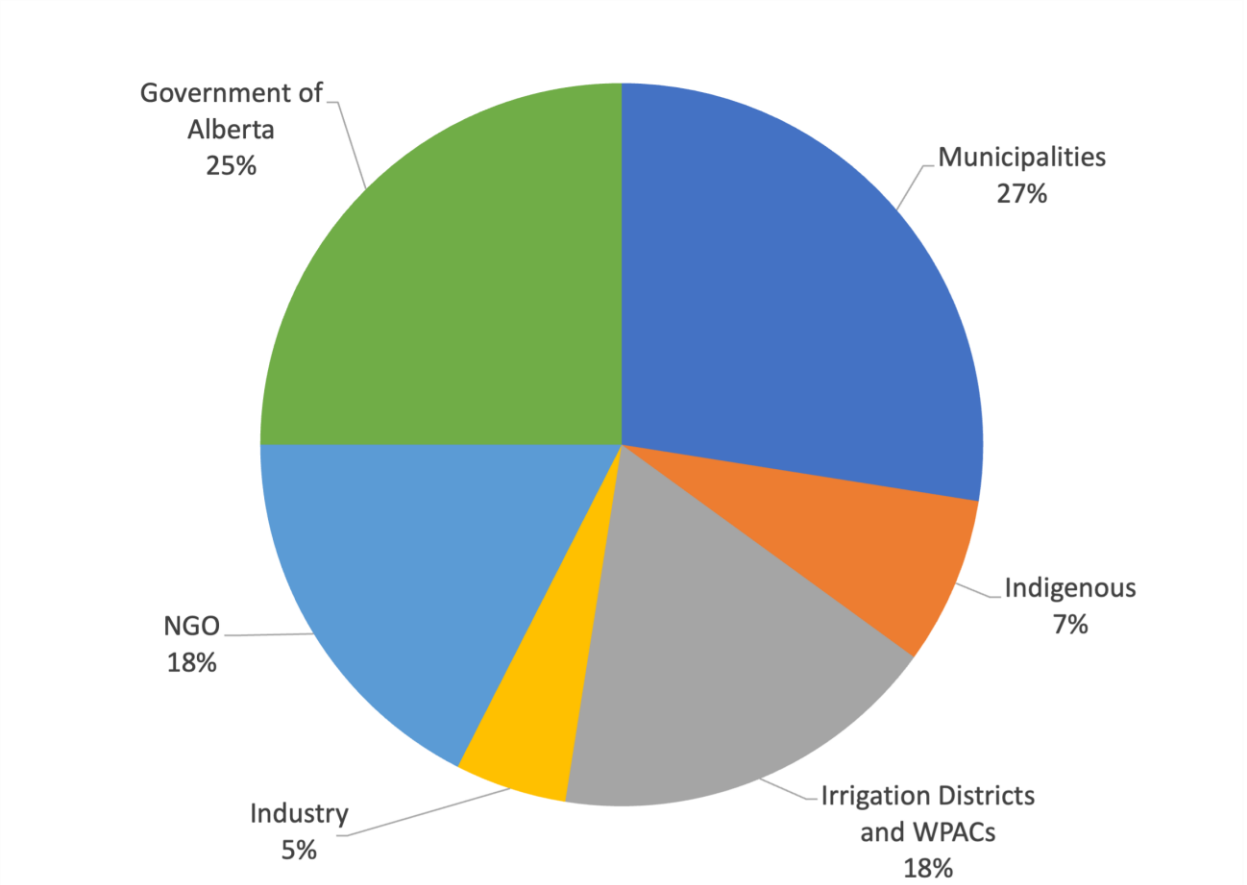

Figure 4: Workshop Breakout Session Survey Responses by Stakeholder Type

Review of responses allowed for fine-tuning of the outcome list and provided a sense of perceived value creation. Appendix III contains the composited results of this breakout session survey.

7.0 Analysis Results

7.1 EcoMetrics Approach to Benefits Analysis

As noted in Section 2.2, 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, we have 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.

In EcoMetrics, we divided the SROI Map into four stages, and sections 7.2, 7.3, 7.4, 7.5, and 7.6 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 project. Figure 4 is a conceptual flow diagram illustrating the SROI Mapping process.

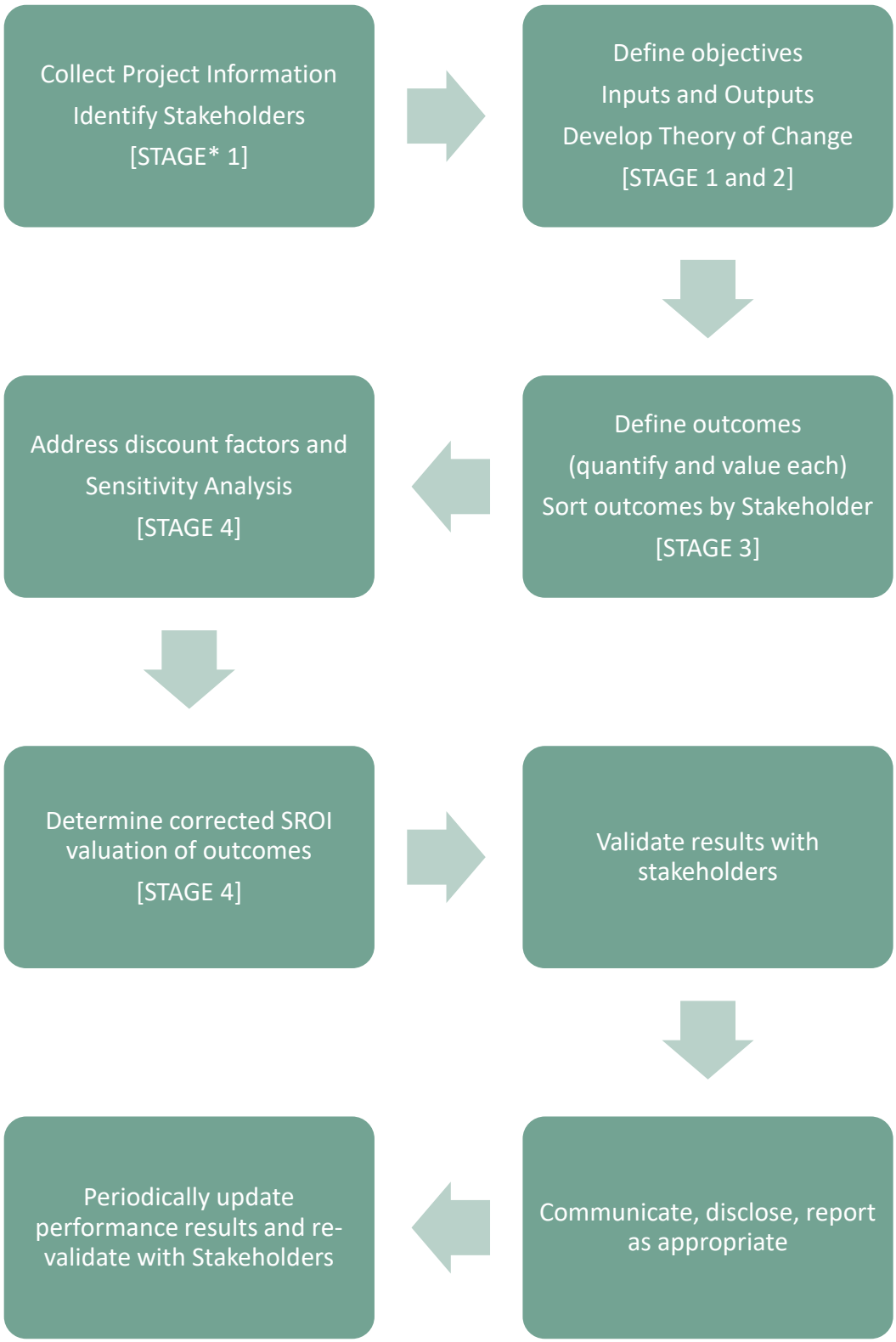

Figure 5: Conceptual SROI Mapping Flow Diagram

7.2 Inputs and Outputs- SROI Map Stages 1 and 2

The critical input is the direct financial investment in building the infrastructure for those options where it is applicable. Some options are based on operational improvements and do not have a construction investment component. Table 5 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 increased water availability, which in turn triggers a number of impacts. These impacts, which include benefits, can be attributed to the stakeholders.

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

- The Environment
- General Public
- Local Economy
- Local Government
- Recreational Users
- Producers

This grouping differs slightly than 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 overlap of actual individual stakeholder because producers are part of the general public, and the benefits 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, what changes can be determined as informed by research, direct observation, and stakeholder input. These are the outcomes. Table 6 builds on Table 5 by identifying the outcomes sorted by the stakeholder that they benefit. Specifics on how these outcomes are defined and valued are explained in Table 6.

The table describes which outcomes were selected for this study as well as the stakeholder to which the benefit is assigned. There is of course 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 might provide a combination of different benefits based on its inherent qualities (for example, trees in a forest provide high levels of carbon sequestration, wetlands can effectively dampen storm effects, etc.). Not all land types are assigned all benefits, and some land types may have higher values for certain benefits as compared to others. For this project,

many proxy values are assessed either on an annual “per acre” value basis or on a per acre-foot of water basis. Non-acre or non-ac-ft values, though fewer, were done using the applicable metric, such as “per resident” or “per student”, also on an annual basis. For this project, the main land cover type that used acres as a basis was irrigated agricultural land.

Table 6: Outcomes by Stakeholder with Definitions and Proxy Values

Value Type	Stakeholder Group	Outcome	Outcome Description (with conversion as applicable)	Calculation of Value	Proxy (CAN dollars)	Citation Number*
Social	Environment	Agriculture Developed: 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.	27.00	1
		Agriculture Developed: 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	1282.48	2
		Agriculture Developed: 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	16.00	3
		Agriculture Developed: 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	15.33	4
		Agriculture Developed: 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	4.12	5
		Agriculture Developed: Soil Stabilization	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	14.79	6

		Agriculture Developed: Waste Treatment	Recovering mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.	Number of acres is multiplied by the value of equivalent waste treatment to same nutrient levels per acre per year, over the lifetime of the project	58.26	7
		Agriculture Developed: 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	169.72	8
		Agriculture Developed: 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	11.28	9
	General Public	Cultural and aesthetic value of rivers	Enjoying and appreciating the scenery, sounds, and smells of nature.	Number of visitors per year is multiplied by the cultural and aesthetic value of river, over the lifetime of the project	347.00	10
		Agriculture Developed: 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	68.84	11
		Agriculture Developed: Cultural Value	Providing opportunities for communities to use lands with spiritual, religious, and historic importance	Number acres is multiplied by the value per acre per year, over the lifetime of the project	94.00	12
		Agriculture Developed: Drought Resiliency (for Ag)	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	78.00	13
		Agriculture Developed: Food Provisioning	Producing crops, fish, game, and fruits	Average revenue for food crops in Alberta in dollars per acre.	1145.00	14
		Agriculture Developed: 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	32.88	15

		Agriculture Developed: 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	134.78	16
		Agriculture Developed: INCREASED Property Value	Difference in economic value between irrigated cropland and non-irrigated cropland.	[(average $ irrigated crop land/acre) -(average $ non irrigated crop land/acre)] (additional acres to be irrigated by the project). This is a one-time value, not annual.	9,800	17
		Agriculture Developed: DECREASED Property Value	Economic value of land (crop and pasture) in the Alberta Province that will be lost due to the construction/expansion of water infrastructure	(average $/acre of land used for agricultural activities) (acres lost to water infrastructure). This is a one-time value, not annual.	4,420	18
		Environmental Flows: 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	4,165	19
		Municipal Growth: GDP	Access to more water may result in population grow 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	73,742	20
		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	809.00	21
	Local Economy	Agriculture Developed: Agricultural Economy	Economic outputs of the agricultural sector	Number of acres times value per acre over the lifetime of the project	1213	22
		Agriculture Developed: Wildfire Risk ~~R~~eduction	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	188	23
		Construction: Total GDP Increase				24

		Construction: Total Labor Income				25
		Construction: Total Tax Revenue				26
	Local Government	Agriculture Developed: 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	2.00	27
	Recreational Users	Environmental Flows: General Recreation	Experiencing the natural world and enjoying outdoor activities.	Annual benefits of recreation/person in Alberta multiplied by the number of habitants in Alberta, over the lifetime of the project	4,029	28
Market	Producers	Agriculture Developed: 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.	29	29

7.3.1 Construction-related Outcomes

As part of the overall analysis performed by EcoMetrics to value outcomes, one subset of calculations uses the methodology called the Input-Output (I-O) Analysis. I-O analysis describes the interdependent supply chains between sectors within an economy. It shows how the outputs of one sector flow into another sector as inputs. In the input-output analysis model, the total economy-wide impact of an economic event can be analyzed from the initial demand change and its direct, indirect, and induced impacts[i].

- **Direct impacts** are the impacts of a change in final demand on the consumption of the directly associated inputs. For example, building a dam requires steel, concrete, workforce, and construction machinery. It thus has a direct impact on these inputs.
- **Indirect impacts** are the impacts due to the suppliers of the directly associated inputs hiring workforce to meet the increased demand.
- **Induced impacts** account for the increase in personal consumption of goods and services resulting from the workers of suppliers.

The estimated economic categories of Gross Domestic Product (GDP), and Labour Income have been estimated in the three aforementioned categories (direct, indirect, and induced impacts), primarily for the construction efforts in certain options. These outcomes are in addition to the outcomes created by the use of the additional water. Those use-related outcomes are mostly recurring, as compared to essentially "one time" benefits associated with the construction phase.

Construction-related outcomes were only calculated for the eight outcomes that involved some kind of construction activity. These eight are (listed in alphabetical order):

- Ardley
- Belly River
- Eyremore
- Kananaskis Dam
- Spray Lakes Reservoir
- Upstream Bow
- Waterton - St. Mary's Canal
- WID Offstream Storage

Data Sources:

The primary source of data used to perform the I-O analysis was sourced from the Government of Alberta's 'Economic Multipliers By Industry and Commodity' for 2019[ii]. Estimates related to construction costs were sourced from previously completed reports (where available) that are in the public domain as well as through discussions with working group members. These costs are rough estimates and are not based on a comprehensive scoping study of costs conducted by WSS or EcoMetrics.

Assumptions:

- Since the data from the Government of Alberta is from 2019, all cost estimates that were entered into the I-O model were adjusted for inflation to 2019. The model results were then converted back to 2023 dollars.
- The two broad categories of costs used in the I-O analysis were *Goods* and *Services*.
- The economic analysis performed for the "Alberta Transportation Springbank Off-Stream Reservoir Project" was used as a reference for the I-O analysis.
- The estimated construction costs are shown in Table 7 below:

Table 7: Estimated Construction Costs

Option	Estimated Construction Cost *(millions)*
Upstream Bow	$1,052
Eyremore	$1,500
Ardley	$1,500
Belly River	$300
Kananaskis Dam Improvements	$310
Spray Lakes	$125
Waterton and SMC	$130
WID Off-stream	$79

Industry Categories:

To perform the Input-Output Analysis, the following industry and commodity codes, as defined by the Government of Alberta Economic Multipliers were utilized. These codes map to the cost categories that are expected to make up the major costs associated with the construction activities. It is important to note that this is not an exhaustive list and is used primarily as a basis for comparison. The codes are listed in alphabetical order:

- Architectural, engineering and related services [BS541300]
- Cement [MPG327301]
- Fabricated steel plate and other fabricated structural metal [MPG332302]
- Logging, mining and construction machinery and equipment [MPG333102]
- Other engineering construction [BS23C500]
- Other miscellaneous general-purpose machinery [MPG333909]
- Stone [MPG212310]

Outcome Categories:

The outcome categories for which results were generated through the I-O analysis are:

- Gross Domestic Product (GDP) at Market Prices
- Labour Income

The estimated total economic effect (Direct, Indirect, Induced impacts combined) across the two outcome categories for each option is shown in Appendix IV.

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 option. For this Road Map Options analysis, the primary and overarching result of implementing an option would be an increase in water availability. Outcomes are related to this increase in water availability and represent impacts and changes that would occur. In EcoMetrics, the increase in water availability in and by itself is simply an output of the option. The actual outcomes relate to what that increase in water 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, as well as more water for irrigation which leads to more food, and so on.

For attaching values to outcomes, EcoMetrics used a meta-analysis and benefits transfer approach. The goal was to find the most up to date peer-reviewed materials to use for the calculation of financial proxies across outcomes. Projected water volumes of additional availability were based on information provided by WSS via the modeling work.

For other parameters, EcoMetrics looked for the most regionally specific calculations beginning from local and regional information to the Canadian national level. Peer-reviewed figures from federal and state 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. Many of these values were drawn from data sources that have met the standard of social value as established by SVI and priority was given to projects that have been assured by this organization. The appropriate use and application of third-party proxies in this analysis was guided by internationally recognized standards. It is important to note that the construction-related I-O approach utilizes historical data. The most recent data set on economic activity and economic multipliers developed by the Government of Alberta (https://open.alberta.ca/opendata/alberta-economic-multipliers-by-industry-and-commodity) is from 2019. Therefore, the analysis and its results have been adjusted for the time value of money and are shown in 2023 dollars.

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 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 sale of real estate or 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 crop or livestock. Agricultural land management has many positive impacts to air quality, water quality, biodiversity, flood protection, and others- all of which provide tangible benefit 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. 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, such as in California, 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. Also, the EcoMetrics analysis alone does not typically conform to the level of validation and verification requirements of some registries and that would need to be done above and beyond the EcoMetrics analysis. 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 assumes 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. For this

project, we assumed that any nitrogen or phosphorus tradeable credits would come from the agricultural component. But increased agriculture actually releases more of these nutrients into surface water runoff than non-agricultural use, therefore there would be no reductions that would qualify as tradeable credits in most trading programs.

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 7.5.1 through 7.5.8. Because this analysis was for predictive comparative analysis of the options and focused on net change, some of the corrections required by SVI are either not applicable or have been modified as described below.

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 option 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 increased water availability and no attribution correction is necessary.

7.5.3 Displacement

Displacement means correcting for a benefit that would have occurred if the project did not occur but have now been "displaced" by the project. As with deadweight, the delta value determination addresses any displacement, and is included as value lost. Displacement appears in the valuation as negative values.

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 options 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 an account. This decision should recognize that there will be many outcomes, and a reporting organization cannot manage and account for all of them. 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, no outcome mentioned by a stakeholder was excluded. In this analysis, the activity (to increase water availability) was the driver to move forward. The primary outcome was intended to make sure there is enough water to address shortages and challenges. However, there are additional expected outcomes as a result of having additional water available that could be put to uses above and beyond addressing an immediate shortage or challenge. This EcoMetrics analysis focuses on those additional co-benefits. As a result, a traditional materiality analysis is not totally applicable in that the additional outcomes are essentially secondary to the intended activity. In other words, there is no expected threshold for the outcomes to drive whether or not an investment is made in a specific option. 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 8 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.

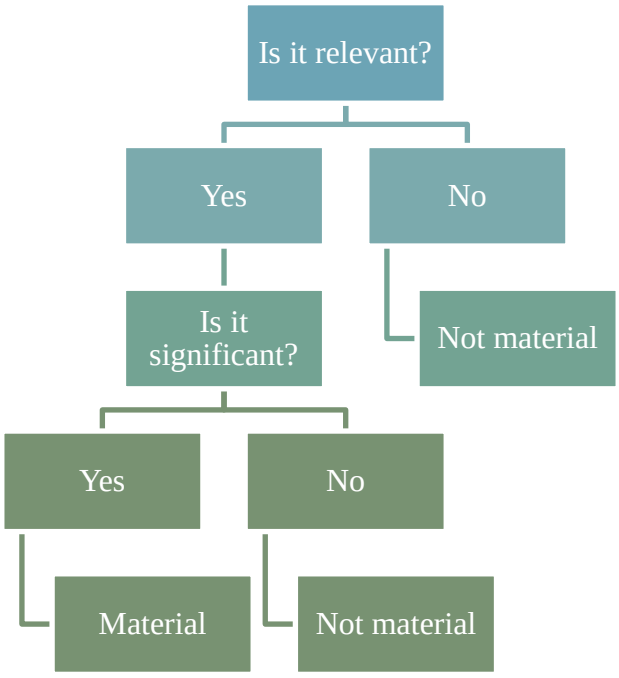

Figure 6: Determining Materiality Through Relevance and Significance

Table 8: Materiality of Outcomes

Stakeholders	Outcome	Was the Outcome Identified by Stakeholders During Qualitative Phase of Research?	Was the Outcome Confirmed by Third Party Research?	Notes
Environment	Soil Stabilization	YES	YES	
	Soil Formation	YES	YES	
	Water Filtration	YES	YES	
	Waste Treatment	YES	YES	
	Nutrient Cycling	YES	YES	
	Biological Control	YES	YES	
	Pollinator Population Support	YES	YES	
	Habitat and Biodiversity	YES	YES	
	Water Regulation	YES	YES	
General Public	Cultural Value	YES	YES	
	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	YES	YES	
	Agricultural Economy	YES	YES	
	Total GDP Increase	YES	YES	
	Total Labor Income	YES	YES	
Local Government	Storm Flooding Protection	YES	YES	
Recreational Users	General Recreation	YES	YES	
Producers	Market value of Carbon Credits	YES	YES	
	Market value of Nitrogen Credits	NO	YES	Based on opportunity analogies
	Market Value of Phosphorus Credits	NO	YES	Based on opportunity analogies

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 options 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 increased water availability. In other words, no value is claimed above and beyond what a specific volume of water 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 purposed for municipal growth support. There is no practical way to correct for 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 option in geographic proximity to one another leads to synergistic effects between options. Each option has been evaluated independently although it is anticipated that two nearby options would have an integrated effect. For example, whereas each option 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 options by themselves. This happens because the reference from which the incremental value was calculated was based on the entire sub-basin, and not just the immediate area around the option location. If two options implemented add to environmental flows within the same sub-basin, it may not be accurate to simply add the recreational opportunities benefit value of each.

7.6 Analysis 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 option was reviewed independently. If multiple options are implemented at the same time, especially those that may affect each other, the valuation would need to be corrected to avoid "double counting."
- 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.

- The methods of quantification and valuation were kept consistent across all options. This allowed for comparative analysis of options even if an assumption was not totally correct. As options are further defined and evaluated, assumptions can be customized more accurately for each option.
- 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 (except the Construction elements and Agriculture Developed-Property Value) is based on annual recurrence. 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. EcoMetrics can calculate this cumulative value created over any desired time frame.
- It is understood that there is necessary additional investment (capital and operation/maintenance) to realize the various noted outcomes. For this phase of work and for other than the construction costs, that information was not clearly defined for each option 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 opportunity for recreational users. It is not the environment or ecosystem itself that is being valued; it is the ecosystem service that is valued.
- 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 option was related to the sub-basin as a whole. For example, population impacts of an option in the Bow River Sub-basin used numbers for the sub-basin as a whole. Once the impact of an option can be more defined to a specific area, a more accurate population growth percentage can be used.

Table 9 contains the key assumptions that changed between options. Specifically, what changes between options is: amount of additional water availability, population of the affected area, number of anticipated additional visitors, and the specific distribution of the water among the three main uses. All other proxies and assumptions were consistent across all options.

Table 9: Selected Assumptions

Option	Basin	Total Ac ft of Water	Residents Added Based on Census Projections (YoY)	Visitors Added	Ag Acres	Acres lost by expansion	Acre Feet for Ag	Acre Feet for Municipal Growth	Acre Feet for Environmental Flows
Ardley Reservoir	Red Deer	463,000	4,200	34,400	131,909	5,000	154,334	154,333	154,333
Dickson Dam	Red Deer	32,430	4,200	34,400	9,239	0	10,810	10,810	10,810
Eyremore Reservoir	Bow	499,998	19,500	34,400	142,450	5,000	166,666	166,666	166,666
Belly River Reservoir	Oldman	54,999	2,373	17,200	15,669	754	18,333	18,333	18,333
Upstream Bow Reservoir	Bow	152,100	19,500	34,400	35,131	568	41,103	41,103	41,103
Kananaskis Dams Improvements	Bow	60,000	19,500	34,400	0	0	0	30,000	30,000
Restore Spray Lakes Reservoir	Bow	60,000	19,500	34,400	0	0	0	30,000	30,000
WID Off-stream Reservoir	Bow	30,000	19,500	0	25,641	350	30,000	0	0
Optimizing Waterton and St. Mary Canal	Oldman	12,161	2,373	0	10,394	0	12,161	0	0
Minimum flow past Lethbridge	Oldman	32,430	2,373	17,200	0	0	0	16,215	16,215
Natural infras restoration and conservn	SSRB	0	NA	NA	0	NA	NA	NA	NA
Description		Based on information provided	Population times percent growth	Based on Province projections	Based on acres of irrigated land supported per ac ft of water	Acres to be flooded	Based on agreed to percentage of total water	Based on agreed to percentage of total water	Based on agreed to percentage of total water

Notes
All values are increases over current conditions.
Total Project acres is ag acres plus reservoir acres.
If increased irrigation is not noted as one of the intended uses, ag acres noted as 1 acre for computational purposes.
Unless otherwise specified, total ac ft available divided evenly among the three uses.
Assumes increase in visitors is 1% of current regional visitor count (except, Belly River which was 0.5%).
Assumes 1.17 acres of irrigated acres per ac ft of available water.
If specified, acreage flooded by expansion noted as reservoir acres.

Table 10 provides a composite compilation of outcome values across all options and illustrates the relationship between outcomes, the stakeholder groupings used in the valuation analysis, and whether the outcome is generating Market of Non-Market Value (Social). The outcomes are noted as either agricultural development, municipal growth, or environmental flows. 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. Table 10 provides a sense of comparative impact, however it should not be used to comprehensively prioritize or rank options in that there are many other criteria involved in the decision-making process beyond the value of the outcomes. A significant benefit of establishing a customized version of EcoMetrics for the options is that any change to assumptions can be very easily made and values recalculated.

Table 10: Outcomes Values by Stakeholder All Options Summary

Value Type	Stakeholder Group	Outcome	Value				
			Ardley	Belly River	Dickson Dam	Eyremore	Increased Flows Past Lethbridge
Social	Environment	Agriculture Developed: Biological Control	$3,426,543	$402,705	$249,453	$3,711,150	-
		Agriculture Developed: Habitat and Biodiversity	$119,675,187	$14,064,845	$8,712,377	$129,615,350	-
		Agriculture Developed: Nutrient Cycling	$2,030,544	$238,640	$147,824	$2,199,200	-
		Agriculture Developed: Pollinator Population Support	$1,945,515	$228,647	$141,634	$2,107,109	-
		Agriculture Developed: Soil Formation	$522,865	$61,450	$38,065	$566,294	-
		Agriculture Developed: Soil Stabilization	$1,876,984	$220,593	$136,645	$2,032,885	-
		Agriculture Developed: Waste Treatment	$7,393,718	$868,948	$538,264	$8,007,837	-
		Agriculture Developed: Water Filtration	$21,538,995	$2,531,374	$1,568,043	$23,328,014	-
		Agriculture Developed: Water Regulation	$1,431,534	$168,241	$104,216	$1,550,436	-
	General Public	Agriculture Developed: Aesthetic Value	$11,936,800	$5,968,400	$11,936,800	$11,936,800	$5,968,400
		Agriculture Developed: Carbon sequestration- social value	$10,355,774	$1,217,064	$753,902	$11,215,920	-
		Agriculture Developed: Cultural Value	$11,929,446	$1,402,010	$868,466	$12,920,300	-
		Agriculture Developed: Drought Resiliency (for Ag)	$9,898,902	$1,163,370	$720,642	$10,721,100	-
		Agriculture Developed: Food Provisioning	$145,310,805	$17,077,675	$10,578,655	$157,380,250	-
		Agriculture Developed: Nitrogen Retention- social value	($9,402,231)	($1,104,998.66)	($684,484)	($10,183,176)	-

		Agriculture Developed: Phosphorus Retention- social value	($28,486,895)	($3,347,926.80)	($2,073,852)	($30,853,003)	-
		Agriculture Developed: Property Value	$1,243,708,200	$146,167,000	$90,542,200	$1,347,010,000	-
		Environmental Flows: Physical Health	$143,276,000	$71,638,000	$143,276,000	$143,276,000	$71,638,000
		Municipal Growth: GDP	$309,716,400	$174,989,766	$309,716,400	$1,437,969,000	$174,989,766
		Reservoir: Property Value	-	-	-	-	-
		Enhanced Environmental Flows	$3,397,800	$1,919,757	$3,397,800	$15,775,500	$1,919,757
	Local Economy	Agriculture Developed: Agricultural Economy	$153,940,617	$18,091,895	$11,206,907	$166,726,850	-
		Agriculture Developed: Wildfire Risk Reduction	$23,858,892	$2,804,020	$1,736,932	$25,840,600	-
		Construction: Total GDP Increase	$1,068,000,000	$214,000,000	-	$1,068,000,000	-
		Construction: Total Labor Income	$707,000,000	$141,000,000	-	$707,000,000	-
	Local Government	Agriculture Developed: Storm Flooding Protection	$253,818	$29,830	$18,478	$274,900	-
	Recreational Users	Environmental Flows: General Recreation	$2,648,000	$1,324,400	$2,648,800	$2,648,800	$1,324,400
Market	Producers	Agriculture Developed: Market value of Carbon Credits	$5,886,547	$691,817.36	$428,542	$6,375,481	-
		Total Value Created	**$3,973,071,561**	**$813,817,521**	**$596,708,709**	**$5,257,153,597**	**$255,840,323**

Table 10: (continued): Outcomes Values by Stakeholder All Options Summary

Value Type	Stakeholder Group	Outcome	Value				
			Kananaskis Dam	Spray Lakes Reservoirs	Upstream Bow	Waterton - St. Mary's Canal	WID Offstream Storage
Social	Environment	Agriculture Developed: Biological Control	-	-	$948,537	$280,638	$682,857
		Agriculture Developed: Habitat and Biodiversity	-	-	$33,128,533	$9,801,542	$23,849,413
		Agriculture Developed: Nutrient Cycling	-	-	$562,096	$166,304	$404,656
		Agriculture Developed: Pollinator Population Support	-	-	$538,558	$159,340	$387,711
		Agriculture Developed: Soil Formation	-	-	$144,740	$42,823	$104,199
		Agriculture Developed: Soil Stabilization	-	-	$519,587	$153,727	$374,054
		Agriculture Developed: Waste Treatment	-	-	$2,046,732	$605,554	$1,473,454
		Agriculture Developed: Water Filtration	-	-	$5,962,433	$1,764,070	$4,292,389
		Agriculture Developed: Water Regulation	-	-	$396,278	$117,244	$285,282
	General Public	Agriculture Developed: Aesthetic Value	$11,936,800	$11,936,800	$11,936,800	-	-
		Agriculture Developed: Carbon sequestration- social value	-	-	$2,866,690	$848,150	$2,063,746
		Agriculture Developed: Cultural Value	-	-	$3,302,314	$977,036	$2,377,354
		Agriculture Developed: Drought Resiliency (for Ag)	-	-	$2,740,218	$810,732	$1,972,698
		Agriculture Developed: Food Provisioning	-	-	$40,224,995	$11,901,130	$28,958,195
		Agriculture Developed: Nitrogen Retention- social value	-	-	($2,602,729)	($770,054)	($1,873,719)

		Agriculture Developed: Phosphorus Retention- social value	-	-	($7,885,754)	($2,333,111)	($5,676,997)
		Agriculture Developed: Property Value	-	-	$344,283,800	$101,861,200	$247,851,800
		Environmental Flows: Physical Health	$143,276,000	$143,276,000	$143,276,000	-	-
		Municipal Growth: GDP	$1,437,969,000	$1,437,969,000	$1,437,969,000	-	-
		Reservoir: Property Value	-	-	($414,640,000)	-	-
		Enhanced Environmental Flows	$15,775,500	$15,775,500	$15,775,500	-	-
	Local Economy	Agriculture Developed: Agricultural Economy	-	-	$42,613,903	$12,607,922	$30,677,983
		Agriculture Developed: Wildfire Risk Reduction	-	-	$6,604,628	$1,954,072	$4,754,708
		Construction: Total GDP Increase	$221,000,000	$89,000,000	$749,000,000	$93,000,000	$56,000,000
		Construction: Total Labor Income	$146,000,000	$59,000,000	$496,000,000	$61,000,000	$37,000,000
	Local Government	Agriculture Developed: Storm Flooding Protection	-	-	$80,842	$20,788	$50,582
	Recreational Users	Environmental Flows: General Recreation	$2,648,800	$2,648,800	$2,648,800	-	-
Market	Producers	Agriculture Developed: Market value of Carbon Credits	-	-	$1,874,888	$482,115	$1,173,098
		Total Value Created	**$1,978,606,100**	**$1,759,606,100**	**$2,920,061,437**	**$295,451,224**	**$437,183,461**

Table 11: Outcome Value by Stakeholder; Wetlands NBS Case Study

Value Type	Stakeholder Group	Outcome	Value
Social	Environment	Wetlands: Soil Stabilization	$187,611
		Wetlands: Water Filtration	$215,424
		Wetlands: Waste Treatment	$662,092
		Wetlands: Nutrient Cycling	$123,274
		Wetlands: Biological Control	$68,222
		Wetlands: Habitat and Biodiversity	$296,245
		Wetlands: Genetic Resources	$84,055
		Wetlands: Water Regulation	$202,471
		Wetlands: Soil Stabilization	$187,611
	General Public	Wetlands: Medicinal/ Ornamental Resources	$15,329
		Wetlands: Raw Materials	$20,627
		Wetlands: Cultural Value	$302,634
		Wetlands: Aesthetic Value	$135,093
		Wetlands: Air Quality - Other GHG	$13,386
		Wetlands: Food Provisioning	$403,441
		Enhancing Rural Community Resources	$2,352,800
		Wetlands: Carbon sequestration- social value	$1,553,664
		Wetlands: Nitrogen Retention- social value	$53,134
		Wetlands: Phosphorus Retention- social value	$37,844
	Academia	Scientific education	$1,240
	Local Government	Wetlands: Water Supply/Quantity	$1,933,596
		Wetlands: Storm Flooding Protection	$1,049,171
	Recreational Users	Wetlands: General Recreation	$343,293
Market	Landowner	Wetlands: Market value of Carbon Credits	$883,151
		Wetlands: Market value of Nitrogen Credits	$38,262
		Wetlands: Market Value of Phosphorus Credits	$2,885
		Total Value Created	**$10,978,943**

7.6.2 Understanding Table 10

The analysis of options creates a significant amount of information. Table 10 provides a high-level presentation of valuation results for each of the analyzed options. The most important point to consider in reviewing the table is that this is an analysis of outcome value created for many stakeholders and is not representing direct income to any one entity.

7.6.2.1 Water Use Categories

For each option, the table presents a percentage of the total recurring value created. The bottom three rows reflect the total value created by the volume of water used for the specific category previously mentioned (agriculture development, municipal growth, enhanced environmental flows). For projects that only include one of the three uses, this chart is not included as it would be 100% of one-use share. The percentage of value in each category reflects the percentage of the total value created in that specific use. This is based on use, not beneficiary. In other words, the percentage noted for agricultural development is the value created for many stakeholders by that land use, not value created for the producers or growers as revenue.

Agricultural irrigated land use has many environmental economic, and social outcomes, in part because it is so closely linked with the environment and ecosystems. Property Value increase as a result of irrigation also dominates the category but this is a one-time value and is not recurring and is therefore not included in the total for this table.

Municipal growth is an aggregated metric that is measured as GDP per capita. An increase in population has many impacts as more people create more impacts. Some of these are positive and some are negative. By using per capita GDP, it is a useful high-level metric that captures not only the benefit but reflects income to the municipality to support the impacts of more people such as water management, traffic, and others. For this initial level of option analysis, using a per capita GDP allows for appropriate side by side comparison of options. For each option, the amount of population growth is based on how many individuals could be supported by the amount of water designated for municipal growth (using an ac ft/person/year metric). This results in this water use category dominating the percentages for applicable options because a high number of people can be supported per acre foot, and each person generates a substantial GDP contribution.

Environmental flows reflect the benefits associated with more resilient and desired river flows. 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. 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.

7.6.2.2 Stakeholder Categories

The rest of the table is the same total value created but sorted by the affected stakeholder. This value is not a direct revenue or income realized by the stakeholder- but instead reflects the value created that benefits that stakeholder group. For example, there is a social cost of carbon measured as a dollars per ton. By calculating the amount of carbon sequestered via added agricultural land, we can calculate the avoided social cost of that carbon that is now not being released into the atmosphere. There is no direct recipient of revenue, but it is a reduced cost, and hence value created, for the community as a whole. As is typical for nature-based outcomes, the general public is the primary and dominant beneficiary (except in the case of Waterton/St. Mary's and WID where there is no water noted for municipal growth or enhanced environmental flows). There is also value created for the stakeholder group "producers" and this is Market value related to sale of carbon credits. However, general agricultural economic value as a whole is listed for the general public as it benefits many beyond the actual producer.

7.6.3 Special Options

There were two other Road Map options analyzed that were of a more general nature and not a specific location. These are Stormwater Reuse and Nature Based Solutions. These two options were analyzed differently as described below as there was no specific location or water volume defined.

7.6.3.1 Stormwater Reuse Option

If the assumption is made that stormwater captured for reuse would reduce extraction from the river, a conceptual unit value can be determined using proxies for enhanced environmental flow. Using this approach, and based on the generalized proxies used in the Road Map analysis, an acre-foot for stormwater reused would allow an acre-foot to remain in the river at an enhanced environmental flow value of approximately $9,700 CAD/ac ft. This value would be $13,643 CAD/ac ft if used to support municipal growth. This would need to be compared for the infrastructure costs to capture and treat the stormwater such that it can be used for what the river extraction supported. This option must also consider that captured stormwater is removed from the drainage patterns which could cause shortages elsewhere that depended on it for flow levels.

7.6.3.2 Nature-Based Solutions and Natural Infrastructure Option- Wetlands Case Study

Nature-Based Solutions (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 typically provide a suite of benefits thereby significantly increasing the value created per unit investment.

For example, a constructed wetlands generates benefits including:

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

These many benefits affect multiple stakeholders. To demonstrate value created, a valuation analysis was done for a hypothetical 100-acre wetlands creation. The various benefits create a total annually recurring value of $11 million with proportions of value by stakeholders as depicted in Table 11 and Figure 7. This example is wetlands creation. In cases where wetlands are being restored, the incremental value increase would be less, all else being the same, because there would have already been wetlands-related outcomes present. This would be a good

example of needing the displacement correction of section 7.5.1 in that some outcomes would occur anyway, without the restoration.

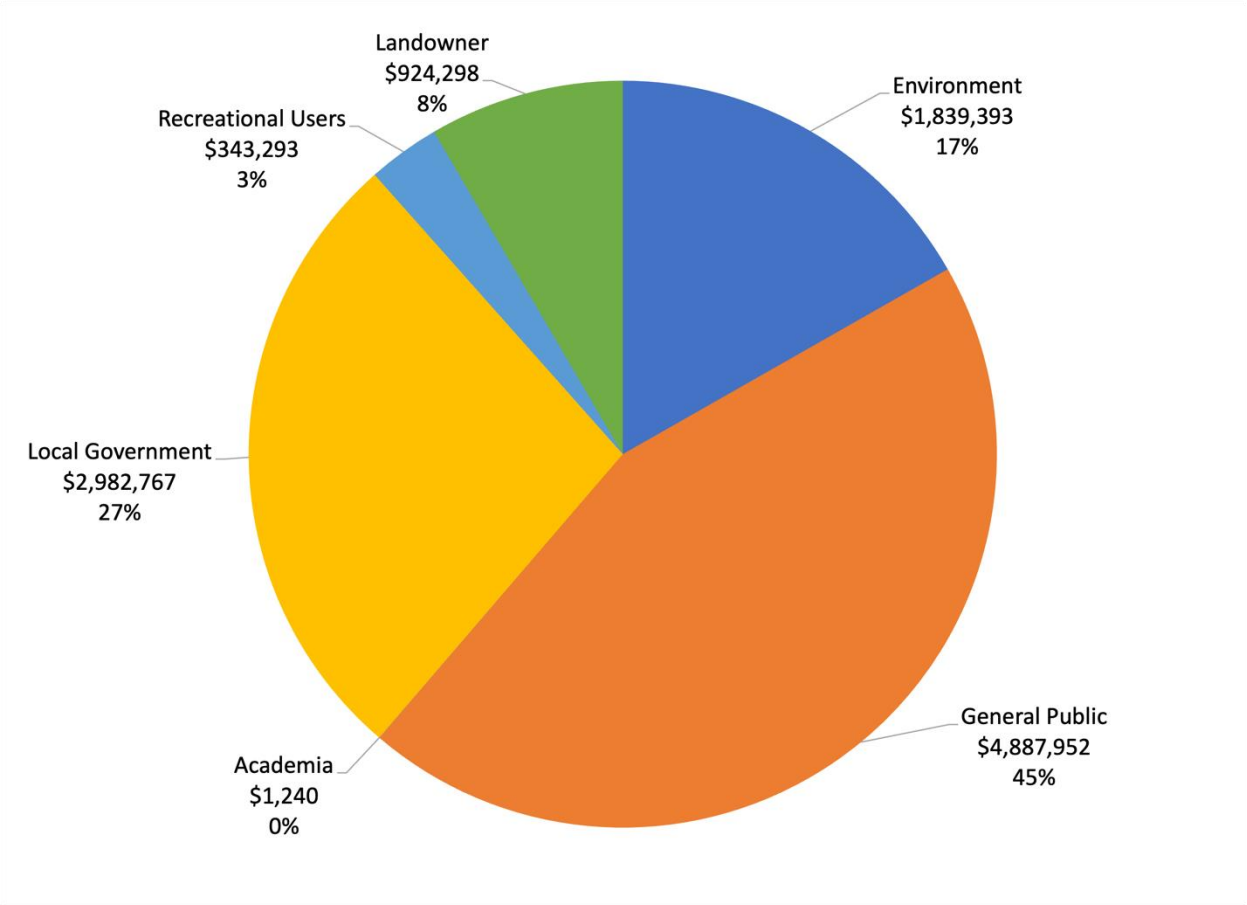

Figure 7: Nature-Based Solutions, Created Wetlands 100-Acre Case Study

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 compensating 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 Sensitivity Analysis

Selected outcomes were assessed under a Low and High Sensitivity analysis, where ranges of key valuation proxies were tested while keeping projected available water volumes constant (Table 12). Proxies tested for sensitivity included those in which the range of potential value estimates was available and reliable. Outcomes not chosen for sensitivity analysis either had a high confidence level for the proxies used, or there was not a justifiable enough reason to test a specific range of values.

Table 12: Sensitivity Analysis for Selected Outcomes

Outcome	Current Proxy	Low Estimate Proxy	High Estimate Proxy	Current SROI Values	Totals of Changes in Study Value - LOW ($)	Totals of Changes in Study Value - HIGH ($)	Justification for Changes
Enhanced Environmental Flows	809 (2012 money) / 1603.97 (2023)	637 (2012) / 837.76 (2023)	1030 (2012) / 1352.62 (2023)	$1,698,900	$1,337,700	$2,163,000	CURRENT represent the economic benefits of outdoor recreation per person in Canada. This includes recreational fishing, camping in tents, birding and photography/filming nature. “The low and high estimates report the 95% confidence interval of the mean estimate calculated from the 200 weighted bootstrap samples”. Patrick Lloyd-Smith, 2021.
Property Value Reservoir	-4,420	0	0	$3,332,680,000	$0	$0	The negative current proxy reflects the monetary loss of agriculture land that will not be usable due to the construction of a new reservoir, or the increment of water stored in the existing ones. The affected land will have a value of "cero" at least from the agricultural point of view. This may include flooded areas as well as portions of land required for access, maintenance, safety requirements, etc. The proxy reflects the average price per hectare of pasture and crop land)
Property Value Agriculture Developed	9,800	9,800	20,200	$153,556,200	$153,556,200	$316,513,800	The current proxy reflects the difference in economic value between irrigated cropland and non-irrigated cropland. The project assumes that more water would allow the irrigation of land that did not have access to water. The current and low levels were left the same because it is expected that the non-irrigated land will maintain its value.
Population growth	4,827,754.12 (pop in 2023 plus 1.5%)	4,756,408 (pop in 2023)	4,876,031.66	$154,858,200	$0	$309,716,400	Access to more water may result in population growth that will contribute to the economic development in the region. The LOW level assumes that the population in Alberta will not grow (pop as Oct 2023). The CURRENT level assumes that access to more water will not contribute to the population growth, therefore the population will grow as predicted by the government of Alberta (pop as Oct 2023 plus 1.5%). HIGH level assumes that the project will allow an increment of 1.0% in the population on top of what is estimated by the government.

As the project is 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 used herein, or there might be uncertainties in quantification.

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 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 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. For example, within the time frame of this analysis, there was very limited input from the watershed level groups, which are an important stakeholder group.

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 a number of river-scale options to increase water availability 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 could have 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.

8.2 Recommendations

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

- *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 other actual projects.

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 – Pre-Worskhop Survey

September 5, 2023

This survey is a component of the stakeholder engagement element of an EcoMetrics analysis. It is to obtain your insight, as a stakeholder, on anticipated impacts, including benefits, stemming from proposed adaptive water management options that may support economic development in southern Alberta. This information is used by EcoMetrics to more accurately identify, prioritize, quantify, and value benefits from the proposed water management options. The first part of the survey is to identify and rank the current impact and value of water management in the SSRB. The second part addresses anticipated changes based on proposed water management options. The proposed water management options will provide additional water supply to the area. This additional supply provides opportunities for a variety of uses for the water, which in turn will lead to a number of benefits. For example, additional water can mean more resilient supply for residents, or more water for irrigation which can lead to greater crop productivity, and others.

A benefit is a positive impact, but there may be negative impacts as well. In the table below, please note the impact (positive or negative) that you feel currently exists. For each, if possible, choose an impact category from the drop-down menu. Please also rank the impact in terms of how important it is to you, ranging from not very important (1) to very important (5).

In deciding how important it is, consider whether you feel it is a very localized or widespread impact, short lived versus long lived, and/or whether it is large or small impact. There is no right or wrong answer, and you don't need to consider all of these factors. These are more to help you frame your thinking about the impact. The most important aspect is how important the impact is to you and your organization. You can have more than one impact in a given category, and you do not need to have something for every category.

To help you think about impacts, consider the following categories and examples.

- **Ecological/Environmental**- e.g., ecosystems impact, biodiversity, water quantity and quality, etc.
- **Economic**- local economic development, job creation, agriculture, property value, quality of life
- **Cultural/Societal**- Impact to local cultural aspects, local history and values, regional identity
- **Community Enhancement**-community resilience, infrastructure security, secure water supply
- **Education/Research**- K-12 educational opportunities, university-level research opportunities

Current Value and Impact (based on the current state)

This first part of the survey is to get a sense of what you think about the current condition in terms of impacts and benefits that already exist. Using the guidance above, provide your thoughts on current impacts.

Anticipated Value & Impact (once vision is fully implemented)

This second part is to identify and rank the impact and value of anticipated changes resulting from the proposed water management options. Using the guidance above, provide your thoughts on anticipated impacts.

How you would best identify yourself/your organization:

- ☐ Local government
- ☐ Community stakeholder (water user)
- ☐ Education and research
- ☐ Volunteer
- ☐ Employed/contracted by the project
- ☐ Local Business
- ☐ Conservation Group
- ☐ Landowner
- ☐ Agriculture
- ☐ Indigenous Community
- ☐ Resident
- ☐ Other

Current Value and Impact of Water Management *(will have just one table/question here – to establish baseline (as opposed to one baseline per option))*

While you are thinking about the current state of water management, if helpful think about current state in comparison to specific water management options and describe current state in that way.

Impact *(both positive and negative)*	Category	Score (1-5)	Comments?
Free Fill	Drop down list	Drop down list	Free Fill

Anticipated Value & Impact of Water Management Options *(one table to be inserted per water management option, may not be a table pending the functionality of SurveyMonkey)*

Impact *(both positive and negative)*	Category	Score (1-5)	Comments?
Free Fill	Drop down list	Drop down list	Free Fill

Appendix II – Workshop Questionaire

Defining Outcomes

As part of our breakout session discussion, we want to capture and evaluate specific outcomes (impacts, including benefits) that you expect. Please use this worksheet to record your inputs, and we will collect these at the end. This information will be very helpful in the EcoMetrics analysis.

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?

- 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?

- 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 Severe is this Outcome?

- 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?

- 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 Severe is this Outcome?

- 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?

- 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 Severe is this Outcome?

- 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?

- 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 Severe is this Outcome?

- 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?

- 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.)

_____

EcoMetrics Run of Show

October 13, 2023

Discussion Groups

- Today we will be breaking out into three working groups with X, Y, Z each facilitating a group
- Ed Pinero will roam between the breakout groups to ensure conversation is on tract and facilitators receive any needed feedback or guidance
- Each break out group will have a note taker
- 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 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 **45-60minutes.** 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.

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?

How to use the maps

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**

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 Outputs

First, let's distinguish between outputs and outcomes. For these options, in general, the main output is more water available, but you may think of others. What are some potential outputs you think will occur as a result of some of the possible options being considered?

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). Let's first list a few outputs to make sure we are capturing the key ones.

Defining Outcomes – to be filled out on printed handout provided.

To prep participant: What direct impacts do you expect? i.e. as a result of more water what could it benefit – more supply for communities, more supply for ag, etc. With this in mind, 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.

- What positive outcomes could this project have?
- What negative outcomes could this project have?

After questionnaire filled out by participants to be discussed by table:

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

Additional Discussion

- 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?

Appendix III – Breakout Session Survey Scoring Results

Table A1: Breakout Session Survey Scoring Results

Outcome	Type of Impact	Average rating		
		How likely?	How beneficial/ severe?	How widespread?
Agriculture Developed: Habitat and Biodiversity	+	4	3.5	5
	-	3.75	3	2.5
Agriculture Developed: Soil Stabilization	-	3	2	2
Agriculture Developed: Waste Treatment	+	4.17	4.00	2.17
	-	4	4	3
Agriculture Developed: Water Filtration	+	3.83	4.50	3.33
	-	5	4	2
Agriculture Developed: Water Regulation	+	4.64	4.86	4.29
	-	4.5	3	2
Agriculture Developed: Cultural Value	-	3	4	1
Agriculture Developed: Drought Resiliency (for Ag)	+	4	5	4
	-	3	4.5	3
Agriculture Developed: Food Provisioning	+	4	4.25	3.75
Municipal Growth: GDP	+	4.18	4.69	3.90
	-	5	4	5
Reservoir: Property Value	-	5	3.2	1.4
Enhanced Environmental Flows	+	2.33	5.00	2.67
	-	3.67	4.67	2.50
Agriculture Developed: Agricultural Economy	+	4.14	4.71	3.14
Agriculture Developed: Storm Flooding Protection	-	4	4	3
Environmental Flows: General Recreation	+	3.83	3.67	4.00

Appendix IV – Summary of I/O Analysis Results

Option ↓	Estimated Construction Cost	GDP at Market Prices	Labour Income	Total Economic Effect (Only Alberta)
		Direct, Indirect, and Induced Impacts Combined (with Safety Net)		
	(millions)			
Upstream Bow	$1,052	$749	$496	$1,245
Eyremore	$1,500	$1,068	$707	$1,776
Ardley	$1,500	$1,068	$707	$1,776
Belly River	$300	$214	$141	$355
Kananaskis Dams Improvements	$310	$221	$146	$367
Spray Lakes	$125	$89	$59	$148
Waterton and SMC	$130	$93	$61	$154
WID Off-stream	$79	$56	$37	$93

Appendix V – Works Cited

CITATIONS FOR TABLE 6

Citation	Outcome	Proxy source
1	Agriculture Developed: Biological Control	Oregon Department of Agriculture (2000), "Economic analysis of containment programs, damages, and production losses from noxious weeds in Oregon." www.oregon.gov/ODA/PLANT/docs/pdf/weed_body_a.pdf Dube, B., White, A., Darby, H., & Ricketts, T. (2022). Valuation of soil health ecosystem services: Vermont Payment for Ecosystem Services Technical Research Report #5, Version 2. The University of Vermont. de Groot, R., et al. (2012). Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services, 1(1), 50–61.
2	Agriculture Developed: Habitat and Biodiversity	Costanza, R., et al (1997). The value of the world's ecosystem services and natural capital. Nature, 387(6630), 253–260. https://doi.org/10.1038/387253a0 David Suzuki Foundation (2008) Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, https://davidsuzuki.org/wp-content/uploads/2018/02/ontario-wealth-canada-future-value-greenbelt-eco-services.pdf de Groot, R., et al. (2012). Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services, 1(1), 50–61.
3	Agriculture Developed: Nutrient Cycling	Dube, B., White, A., Darby, H., & Ricketts, T. (2022). Valuation of soil health ecosystem services: Vermont Payment for Ecosystem Services Technical Research Report #5, Version 2. The University of Vermont. Caley, B. (2022, May 31). What Is the ROI of Regenerative Ag? Farmers Business Network. https://www.fbn.com/en-ca/community/blog/what-is-the-roi-of-regenerative-ag
4	Agriculture Developed: Pollinator Population Support	David Suzuki Foundation (2008) Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, https://davidsuzuki.org/wp-content/uploads/2018/02/ontario-wealth-canada-future-value-greenbelt-eco-services.pdf. de Groot, R., et al. (2012). Global estimates of the value of ecosystems and their services in monetary units. Ecosystem Services, 1(1), 50–61.
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26	Construction: Total Tax Revenue	Statistics Canada and Input/Output Study by WaterSMART Solutions, 2023
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Citations for Input/Output Analysis

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https://corporatefinanceinstitute.com/resources/economics/input-output-analysis/

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