ECOMETRICS ANALYSIS SUMMARY REPORT

LAKE WINNIPEG BASIN WATER STEWARDSHP PILOT PROJECT: ON-FARM APPLICATION OF THE ALLIANCE FOR WATER STEWARDSHIP STANDARD AND ANALYSIS OF POTENTIAL IMPACT

Winnipeg, Manitoba, CA

PREPARED BY: EDWIN PIÑERO, TAYLOR MARSHALL, HUDA ELASAAD, EMILY PIÑERO; ECOMETRICS LLC

PRODUCED FOR AND FUNDED BY: ALUS Canada, with BASF, General Mills, Nutrien, the J.R. Simplot Company, and The Water Council

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DISCLAIMER: 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 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 regulated water quality trading program, specific methodologies would be used and noted accordingly in the report in the applicable sections.

Glossary

Alliance for Water Stewardship (AWS) Standard	A globally recognized framework for water stewardship, designed to follow a management system process of planning, implementation, checking and measuring, adapting, and adjusting site-level actions to support positive outcomes for watersheds.
Cropland stewardship strategies	This is a group of water stewardship practices that rely upon changes in strategies for land management, such as changes to tillage practices, crop rotations or types, or the use of technological interventions.
Deadweight	Value that would have occurred anyway, regardless of the proposed interventions or actions.
Discount rate	The difference in value for future generations. A lower discount rate implies that a dollar years from now is similar to a dollar today, in terms of value. A higher discount rate implies the dollar is worth more in the future.
Ecosystem services	Positive impact or benefit that nature provides to society. These include: • Direct services, such as water filtration by healthy soils or pollination by wild species • Indirect services, such as increased local economic development associated with more efficient and productive farms
Enhancement of edge-of-field and marginal farmlands	This is a group of outcomes from water stewardship practices that enhance edge-of-field or marginal, uneconomic farmland into natural lands, such as constructing woodland buffer strips, tree and shrub wind breaks and wetlands.
Green infrastructure	Using a nature-based solution in place of traditionally constructed infrastructure; for example, a treatment wetland instead of a water treatment facility.
Impacts	For this study, impacts are the direct or indirect effects on the environment, society, producers, value chain members, or stakeholders resulting from specific water stewardship activities.
Materiality	Process to determine whether a project outcome is relevant and significant (“material”) to warrant inclusion in the analysis. Relevant and significant determinations are made based on stakeholder engagement and third-party scientific literature and studies.

Nature-based solutions	Nature-based solutions include ecosystem services, green infrastructure, and other ways to leverage nature and natural resources to benefit society. Quantifying and valuing the benefits of nature-based solutions allows for incorporation of the value of nature to decision-making.
Outcomes	Conditions and changes anticipated from activities, such as the implementation of water stewardship practices. These outcomes can result either from the **cropland stewardship strategies** and/or the **enhancement of edge-of-field and marginal farmlands**.
Producers	The four farms engaged in the AWS watershed stewardship planning work and this study.
Project Team	An expanded group of stakeholders who were regularly engaged during the AWS watershed plan development phase, including the following organizations: International Institute for Sustainable Development, Manitoba Association of Watersheds, Ducks Unlimited, Redboine Watershed District (RBWD), Central Assiniboine Watershed District (CAWD), Manitoba Forage & Grassland Association, Agriculture & Agri-Food Canada, and the Manitoba Habitat Heritage Corporation.
Project Partners	Partners consisted of the following organizations: ALUS Canada, BASF, General Mills, Nutrien, the J.R. Simplot Company, and The Water Council.
Return on Investment (ROI)	A simple ratio that divides the net value created or lost by the amount invested. For this study, the entity making the investment could be a producer or another entity providing a grant or funding mechanism to implement an action. ROI is the ratio of gain/loss realized the producer or the investor.
Social Return on Investment (SROI)	SROI puts a value on the amount of change (impact) that takes place as a result of the program and looks at the returns to those who contribute to creating the change and others who benefit from it. It estimates a value for this change and compares this value to the investment required to achieve that impact, resulting in an SROI ratio.
Steering Committee	The Steering Committee included personnel from each of the Project Partners organizations.
Social Value International (SVI)	Social Value International is the leading global network for social impact and social value and provides validation for the results of SROI studies.
Water Stewardship Plan	A plan developed in alignment with the AWS Standard by the producers for each of their farms, with support from the Project Partners, that define planned actions and activities.
Water stewardship practices	Any number of technological or nature-based solutions for increasing water efficiency and improving water quality, from soil moisture monitoring to vegetative buffers.

1.0 Executive Summary

This report contains the EcoMetrics analysis of a four-farm pilot implementation of the Alliance for Water Stewardship standard in the Lake Winnipeg Basin in Manitoba, Canada. This report is an aggregated composite of the results of the four farms. Farm-specific information is incorporated in separate reports for each site. The sites are currently active commercial farms that grow various crops on a rotational basis.

The Project Partners engaging in this work are two environmental groups, ALUS Canada and The Water Council, and four agri-food supply chain companies, BASF, General Mills, Nutrien, and the J.R. Simplot Company. Together, these organizations conceptualized a pilot project where select farms would plan and implement a series of water stewardship practices following the criteria and requirements of the Alliance for Water Stewardship (AWS) International Standard version 2.0. Phase I of the project commenced in 2021 and will end in the summer of 2023. Phase I resulted in the development of Water Stewardship Plans for each of the four farms. Prior to the completion of Phase I, the farms had already been implementing many water stewardship practices. It is anticipated that in Phase II, the various practices identified as having a positive impact will seek funding for implementation, and the resulting benefits of water stewardship can be documented. This effort focused on water stewardship practices and does not include other practices already employed by the farms.

During Phase I, the project leadership decided to expand the impact analysis and utilize EcoMetrics to characterize the co-benefits that could be expected to result from the intended water stewardship practices. The intention was to establish which water stewardship practices—if implemented—would drive the most value for the environment, communities, and the value chain. In turn, this would help to establish a business case for off-farm interests to invest in on-farm water stewardship practices and solutions.

Under the direction of ALUS Canada and with the guidance of the Steering Committee, the four farms began their journey to generally conform with the standard by completing Steps 1 (Gather and Understand) and Step 2 (Plan and Implementation Plans). At this time, the producers have not committed to certification to the standard and are not following all criteria exactly. The standard was used more as guidance for developing water stewardship actions through understanding the watershed and engaging stakeholders. Currently, the producers have identified the shared water challenges and opportunities facing the watersheds they are located in and have developed implementation plans describing the various water stewardship practices they could consider to address the challenges.

1.1 Valuing Benefits

The farms and affected stakeholders are expected to realize numerous water-related benefits resulting from the implemented practices. The AWS process focuses on water-related benefits, mainly to qualitatively describe, and in some cases, quantify, the benefit. The EcoMetrics analysis goes on to identify, quantify, and value the other co-benefits stemming from the same

practices. The comprehensive benefits of this project – 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 associated with nature-based solutions and incorporates the guiding principles of Social Value International's (SVI) Social Return on Investment (SROI) Methodology. The major stakeholder groups who will benefit from the water stewardship practices include:

- **Producers** who will realize water savings and reduced water supply risks, improved water regulation, increased crop productivity, less soil erosion, and a number of other benefits
- **Agri-food Supply Chain companies** who will benefit from an enhanced social license to operate and more efficient and resilient supply chain
- **Municipal, Provincial, and Federal Government** will benefit from increased water capacity, reduced runoff infrastructure costs, reduced damage costs related to flooding, more success in meeting environmental goals and targets, and a reliable tax base
- **Watershed Districts/Water Authorities** who will benefit from lower agricultural impact on watershed shared resources
- **Communities surrounding and near the site (including property and landowners)** who benefit from improved water and air quality, storm protection, and soil stabilization due to the stewardship practices on the farms, as well as those in the more general region who benefit from better watershed conditions, increased local economic development, and amenity value
- **The Environment,** which benefits all stakeholder groups but in ways that are not immediately apparent to stakeholders or may not manifest for several years and include the societal benefits of reduced nitrogen and phosphorus impact (both as contamination for runoff and leaching into groundwater) and the sequestration of carbon

Table 1 shows the results of the valuation of outcomes, sorted by stakeholder, for current conditions and changes anticipated from implementation of the proposed water stewardship practices. The results are categorized by two strategies 'action buckets', the first being practices specifically deployed on croplands (active fields) and the second being actions that focus on the enhancement of edge-of-field and marginal farmlands on the farm property. For this analysis, information from the four farms was aggregated. The delta represents the difference between the current state and the incremental value created over the next 25 years from implementing the water stewardship plans. The key questions the Project Partners wished to solve for with this work follow:

- What can be done to improve on-farm water stewardship outcomes?
- Which water stewardship interventions deliver the most value, and to whom?

To answer the first question, Project Partners used the AWS standard to develop Water Stewardship Plans. For the second question, the results show that the farms already bring value to the community under current operation. Moreover, there is significant value to be gained by implementing the proposed water stewardship practices. We also learn from the analysis that the water stewardship efforts should be a combination of in-field agriculture practices, and

enhancement and stewardship of the natural lands that exist on the farms. Finally, we note that even though the practices are driven by water stewardship commitments, they provide benefits in many other categories and to many other stakeholders, beyond the producers.

Table 1: Outcome Values by Stakeholder

Cropland Stewardship Strategies				
Stakeholder Group	**Outcome**	**Current**	**Stewardship Plan**	**Delta***
Environment & Producers	Soil Formation	$2,829,659	$2,829,659	$0
	Soil Stabilization	-$30,027,351	-$674,339	$29,353,012
	Biological Control	$18,049,378	$18,049,378	$0
Producers	Pollinator Population Support	$10,528,804	$12,527,422	$1,998,618
	Increased Profitability of Sustainable Practices	$0	$135,092,516	$135,092,516
	Reduction of Lake Eutrophication	$0	$1,639,869	$1,639,869
	Soil Health	$0	$14,191,764	$14,191,764
General Public	Air Quality - Dust Particulates	$0	$563,185	$563,185
	Air Quality - Equipment Emissions	$0	$1,325,544	$1,325,544
	Carbon sequestration- Social Value	$28,368,017	$59,785,233	$31,417,216
	Nitrogen Retention- Social Value	-$348,896,940	$305,372,433	$238,276,868
	Phosphorus Retention- Social Value	-$210,130,057	$625,883,464	$585,473,838
	Cultural and Aesthetic Value	$65,082,154	$65,082,154	$0
	Food Provisioning	$103,165,792	$103,592,726	$426,934
Local Governments	Enhancing Rural Community Resources	$1,035,710,097	$1,035,710,097	$0
	Storm Flooding Protection	$0	$771,403	$771,403
	Water Supply/Quantity	-$116,565,463	-$87,424,097	$29,141,366
	Total Social Value	**$558,114,090**	**$2,294,318,411**	**$1,069,672,132**
	TOTAL ($MM)	**$558.11**	**$2,294.32**	**$1,069.67**
Enhancement of edge-of-field and marginal farmlands				
Stakeholder Group	**Outcome**	**Current**	**Stewardship Plan**	**Delta**
Environment & Producers	Biological Control	$4,716,763	$6,289,018	$1,572,254
	Habitat and Biodiversity	$47,902,446	$63,869,928	$15,967,482
	Nutrient Cycling	$10,871,592	$14,495,456	$3,623,864
	Soil Formation	$66,000	$88,000	$22,000
	Soil Stabilization	$17,272,960	$23,030,613	$5,757,653
	Water Filtration	$98,217,901	$130,957,201	$32,739,300

	Water Regulation	$70,289,131	$93,718,841	$23,429,710
Producers	Pollinator Population Support	$10,247,314	$13,663,086	$3,415,771
General Public	Air Quality - Other GHG	$6,020,425	$8,027,234	$2,006,808
	Climate Regulation	$3,101,203	$4,134,937	$1,033,734
	Cultural and Aesthetic Value	$18,401,209	$24,534,945	$6,133,736
	Food Provisioning	$12,572,856	$16,763,808	$4,190,952
	Raw Materials	$8,002,030	$10,669,373	$2,667,343
Local Governments	Storm Flooding Protection	$88,552,092	$118,069,456	$29,517,364
	Water Supply/Quantity	$12,918,876	$17,225,168	$4,306,292
	TOTAL	**$409,152,798**	**$545,537,064**	**$136,384,263**
	TOTAL ($MM)	**$409.2**	**$545.5**	**$136.4**

** These figures are the processed valuations for each outcome over the entire project horizon (Year 0 (now) plus 25 years). A number of corrections were applied to these values in the analysis phase; thus, this table is not necessarily additive down the table rows and the delta is not reflective of a simple subtraction across the table columns. Please refer to Section 7 for detailed descriptions of the corrections applied*

*** All values in CAD 2022, 3% Discount Rate Applied*

2.0 Benefits Valuation Background

2.1 Purpose of Benefits Valuation

ALUS Canada, with the support of the other Project Partners, contracted with EcoMetrics LLC to complete the SROI analysis as a means of assessing and valuing the intangible aspects of on-farm water stewardship practice efforts on a variety of stakeholders impacted by this project. Research methodologies were informed by two goals: 1) collecting data to fulfill the requirements of social return on investment report assurance by SVI; and 2) populating the EcoMetrics™ Methodology. EcoMetrics identifies, quantifies, and values (in monetary terms) the social, economic, and environmental benefits of investing in nature-based solutions. The model combines quantitative and qualitative values across numerous social, economic, and environmental categories to forecast the relative social and economic outcomes for corporations interested in investing in nature-based solution projects. The EcoMetrics model was built on the guiding principles of SVI's SROI Methodology and the International Integrated Reporting Council's (IIRC) International Integrated Reporting Council Framework (IIRC).

Stakeholder relationships are of primary importance to both SVI and IIRC methodologies. 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 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.

This report is not an analysis of farm operations nor an assessment of their business model. This report does not focus on the sustainability of water stewardship practices, but rather focuses on understanding the impact that the activities undertaken by the producers will have on stakeholders and themselves. The objectives of this project were to use the SROI methodology to:

- Identify and engage key stakeholders affected significantly by the project – 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 social impacts– Understand the value created as a result of the changes experienced by each stakeholder group by using indicators to measure the outcomes and financial proxies to value the outcomes
- Create a forecast analysis to measure and evaluate the impacts– Articulate the key drivers of social value and identify what data are needed to best measure and evaluate the impacts of activities.

To fully measure and evaluate the impacts of the project, this research incorporates scientific data on the objective impacts of enhanced water stewardship practices on farm operations into the SROI evaluation. These data are directly tied to the outcomes defined by the key stakeholders and used to quantify the social value of environmental change. 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 unfavourability of proposed environmental interventions. Such valuation of outcomes will allow project participants to understand the internalized financial benefits and externalized societal benefits of making investments in so-called “green infrastructure” or natural capital.

2.2 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 a program or activity for significant stakeholders.
- Evaluative, which is conducted 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).

The Lake Winnipeg Basin project is a forecast analysis.

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 such 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 Social 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 program 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 as noted in 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 amount of change (impact) that takes place as a result of the program and looks at the returns to those who contribute to creating the change and others who benefit from it. It estimates a value for this change and compares this value to the investment required to achieve that impact, resulting in an SROI ratio. It takes standard measures of economic return a

step further by placing a monetary value on social returns (Social Ventures Australia, 2011). The development of an impact map demonstrating the impact value chain for each stakeholder group is critical to this process. It links stakeholders' objectives to inputs (e.g., what has been invested), to outputs (e.g., number of acres preserved), through to the outcomes (e.g., increase in income through employment). 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:

- Deadweight – What would have happened anyway?
- Displacement – Were other outcomes displaced to create the outcome?
- Attribution – Who else contributed to the outcome?
- 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 analysis. In addition to these SVI specific corrections, we also account for uncertainty and delayed starts of outcomes.

3.0 Project Background

3.1 The Alliance for Water Stewardship International Standard version 2.0

The AWS Standard was developed via an international multi-stakeholder consensus standards process and is currently owned and managed by the Alliance for Water Stewardship, a membership based non-profit organization. The standard is designed to be implemented at the site level, and organizations can implement the standard, and if so desired, can proceed to get independent third-party validation of conformance, and become certified to the standard. The intent of implementation of part or all of the standard is to achieve improvement in water stewardship. The intent of certification is to have third party independent assurance of conformance to the criteria of the standard. Hence, an implementer need not get certified, or even implement all of the criteria, to realize water stewardship benefits. For this pilot project, producers used the standard as general guidance, and at this time, none of the producers are intending to get certified to the standard.

The standard is designed to follow a management systems process where the implementer plans, implements, checks and measures, and adapts and adjusts practices in order to meet goals. Although the implementer decides what practices they wish to implement and what objective and targets they set, the AWS standard requires performance improvements in the areas of water quantity, water quality, water governance, important water related areas, and water and sanitation

access. The concept behind AWS is that through understanding the water-related challenges and opportunities facing the watershed and setting goals and targets and implementing practices to respond to those challenges, the overall condition of a watershed can be enhanced.

3.1.1 Relationship Between AWS and EcoMetrics

Figure 1 is a flow chart that illustrates the relationship between the AWS process and how EcoMetrics assesses the corresponding value created. The AWS process begins in the top left with understanding watershed-scale challenges and opportunities. One then progresses through developing water stewardship plans that define the goals and activities to be implemented in order to achieve improvements. First, we understand that such activities create value beyond the direct water stewardship-related benefits. Secondly, we realize that is possible to not only quantify these benefits, but also determine the monetary value they create for a variety of stakeholders. The EcoMetrics process, that does this valuation of benefits, transitions in starting in the lower left, and progressing through the right-hand side of the flow chart. In reality, the process is ongoing and iterative, and in the future, as more activities are implemented, valuation of benefits can be updated.

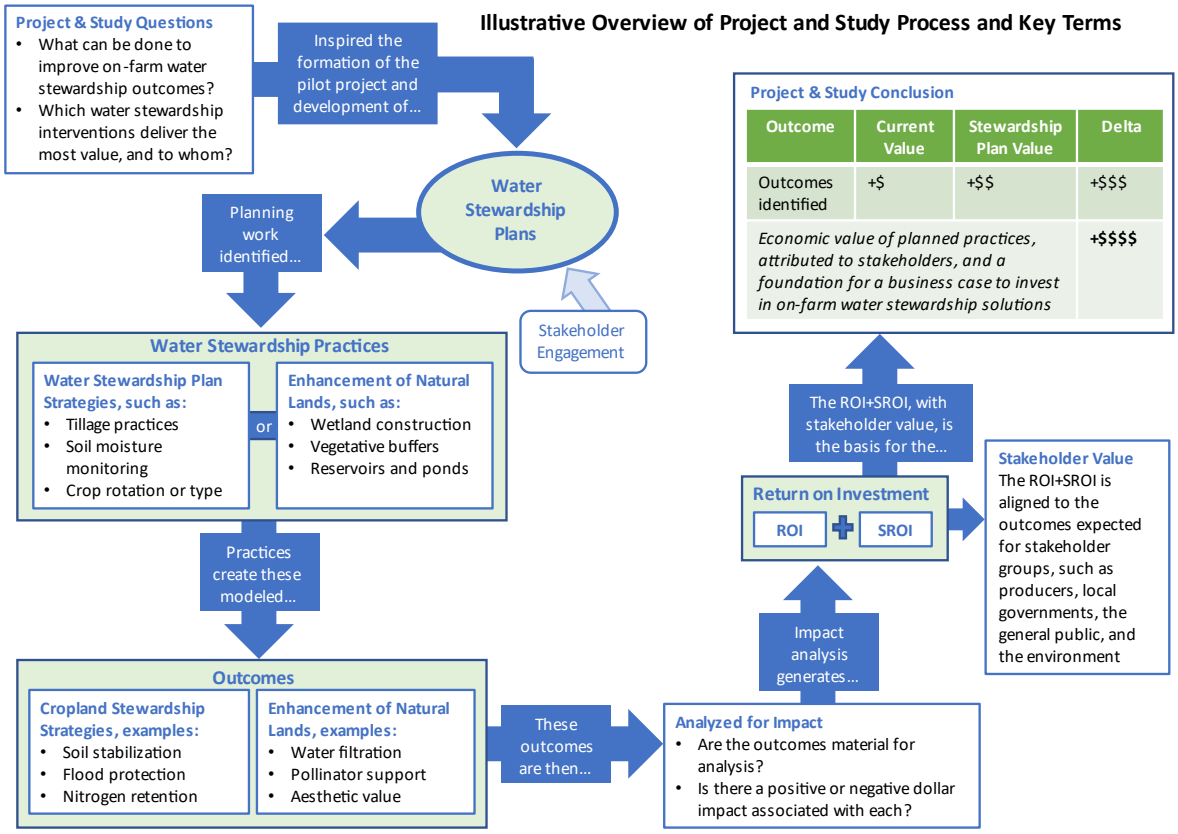

Figure 1: Flow chart relating AWS to EcoMetrics (B. Wilson, 2023)

3.2 Background: Lake Winnipeg Basin and Regional Demographics

The four farms are located in the southern extent of the Province of Manitoba, in the Lake Winnipeg Basin, made up of a number of watersheds. Two of the farms are in the Redboine Watershed and two are in the Central Assiniboine Watershed. Table 3 gives a sense of the population and economic demographics of the area.

Figure 2: Project Location

Table 3: Regional Demographics for Project Area

Spatial Extent	Population			Unemployment			Per Capita Annual Income		
	2016	2021	Percent Change 2016-2021	2016	2021	Percent Change 2016-2021	2015	2020	Percent Change 2015-2021
Winnipeg (CMA*), Manitoba	783,099	834,678	6.6%	6.3%	8.6%	2.3%	$35,706	$40,400	13.1%
Manitoba (Province)	1,278,365	1,342,153	5.0%	6.7%	8.3%	1.6%	$34,188	$39,200	14.7%
Canada	35,151,728	36,991,981	5.2%	7.7%	10.3%	2.6%	$34,204	$41,200	20.5%

*CMA = Census Metropolitan Area

3.3 Engaged Project Organizations and Structure

The Project Partners are ALUS Canada, BASF, General Mills, Nutrien, the J.R. Simplot Company, and The Water Council. Personnel from the Project Partners organizations formed a Steering Committee to lead the project. The Steering Committee recruited four producers to the project, engaging with farms of scale in the target watershed areas. The Steering Committee also established a Project Team who were kept engaged throughout the project through a field visit, a project planning workshop, and regular conference calls. The Project Team organizations included the following organizations: International Institute for Sustainable Development, Manitoba Association of Watersheds, Ducks Unlimited, Redboine Watershed District (RBWD), Central Assiniboine Watershed District (CAWD), Manitoba Forage & Grassland Association, Agriculture & Agri-Food Canada, and the Manitoba Habitat Heritage Corporation. EcoMetrics LLC is a separate entity commissioned to the benefits analysis and is not a party to the project.

3.4 Area Description

Manitoba's primary industries are manufacturing and agriculture, with a variety of resource processing and non-resource-based industries throughout the province. In parts of the province where climate and soil are favorable, a variety of crops are grown including barley, canola, rye, maize, and potatoes among others, with wheat as the dominant crop.

The Lake Winnipeg Basin is in the general southern portion of the Province of Manitoba, in south-central Canada. It is characterized by a mixture of urban, suburban, and rural land use, with the city of Winnipeg as the primary urban center. The landscape and waterways also provide recreation opportunities as part of the local economy. As with other areas in this part of the country, the setting and history is characterized by the interplay of native ecosystems and agriculture. Over the decades, native land has been converted to agriculture. Whereas this is beneficial to the local and regional economy, it does introduce issues such as increased nutrient runoff in waterways, erosion, flooding and other drainage problems, and competition for a limited water supply. The commitment by the agricultural sector to improve water stewardship practices for the betterment of the watershed aligns well with addressing the challenges.

Further exacerbating the water challenges is that Lake Winnipeg is downstream of much drainage that comes from elsewhere in Manitoba as well as from other provinces. The Lake Winnipeg area is also stressed by increased water supply demand upstream in Alberta and Saskatchewan. Significant work has been done over the years studying the interplay of ecosystems and development, especially the impact of agriculture.

Because of the many and large watersheds that make up the basin area, there are number of governance bodies and other non-governmental organizations that must cooperate and coordinate. Generally speaking, the four farms are a combination of a number of specific tracts that exist in either the Redboine Watershed or the Central Assiniboine Watershed.

The Redboine Watershed portion where the farms are located east of the Manitoba Escarpment and is characterized by flat topography and clayey soils. From an agricultural perspective, water used for irrigation comes from the Boyne River, a key feature of the watershed. Conversely, the Central Assiniboine Watershed where the other two farms are located is a hillier and sandier area

and irrigation water comes from groundwater aquifers as well as surface bodies such as the Assiniboine and Cypress rivers.

4.0 Stakeholder Engagement Methodology

4.1 Identifying Stakeholders

The EcoMetrics analysis was initiated and added onto the water stewardship project after it was underway. The AWS process incorporates a very comprehensive stakeholder engagement process that is very similar to the EcoMetrics methodology stakeholder engagement process. The AWS standard requires stakeholder engagement to support the identification of shared water challenges and opportunities facing those located within the watershed. Stakeholders are also part of the process of the implementer's water stewardship plan development, thereby providing information on what they think is important to address, and to share expectation of changes resulting from plan implementation. ALUS Canada facilitated the stakeholder engagement process in accordance with AWS standard criteria. As part of the data gathering stage, ALUS Canada sent a supplemental questionnaire to the producers asking for additional input on expected benefits, including asking the producers to rank expected benefits of water stewardship practices in order of perceived priority. Because of the project parameters and agreements with the producers, EcoMetrics LLC decided to leverage the AWS stakeholder engagement process and findings in lieu of re-interviewing all the key participants. EcoMetrics LLC utilized these various stakeholder engagement efforts to inform the analysis.

Table 4 summarizes the stakeholder engagement details.

Table 4: Stakeholder groups and numbers of represented stakeholders

Stakeholder Group	Number of People
Producer	5 (at workshop)
Agri-food supply chain companies	7 (at workshop)
Community (landowners, nearby residents, etc.)	Multiple via AWS process
Municipal Government	Multiple via AWS process
Provincial Government	Multiple via AWS process
Watershed Districts	Multiple via AWS process
Water Authority	Multiple via AWS process
ALUS Canada (Project Manager)	3 (at workshop)
Total	Multiple via AWS process and workshop

In order to address the EcoMetrics-specific elements of stakeholder engagement, interviews were conducted with the Steering Committee members. Secondly, a workshop was held in Winnipeg in April 2023 with the steering committee, ALUS Canada, and representatives from the four farms. A portion of this workshop was dedicated to EcoMetrics where the process was

described, and additional questions asked. After the workshop, a questionnaire was sent to the producers with additional EcoMetrics-specific information requests and questions.

Finally, several reports prepared by others were reviewed that described stakeholder engagement efforts regarding the watershed.

4.1.1 Description of Stakeholder Groups

In total, 8 stakeholder groups were identified: producers, local communities near farms, residents and businesses in the watershed, supply chain, and government agencies (such as irrigation districts, conservation districts, water management authorities). The environment is considered a stakeholder, but as it cannot speak for itself, other stakeholder groups, such as government agencies and conservation organizations, can serve as proxy stakeholders. Also, subject matter experts used by EcoMetrics LLC also represent the environment. Whereas many others could be considered stakeholders in one form or another, those noted in this section are stakeholders who actively participated in our engagement process. Some of the descriptions below are extracts of the AWS stakeholder engagement documents.

Producers- The four farms are the AWS standard implementing pilot sites. These farms will be implementing the water stewardship practices and will realize most directly benefits stemming from the effort. Producers are also the one making the primary investments necessary to implement the stewardship practices.

Agri-food Supply chain companies- Purchase crops (e.g., potatoes, cereals, and canola) from the farms or provide the farms with materials. Sell products and services to support farming operations, such as crop nutrition and protection products, precision agriculture digital platforms, and farming equipment and technology.

Manitoba Provincial Government-The Water Branch regulates and manages irrigation use, as well as drainage and water control. The Climate, Environment & Biodiversity Branch encourages sustainable pesticide use and nutrient management. Overall, the Government of Manitoba is also responsible for influencing larger, cross municipality water infrastructure projects. Within the provincial government, primary responsibility for water can be found in several departments including Manitoba Infrastructure (flooding and infrastructure), Manitoba Agriculture and Resource Development (Watershed Districts, incentive programming, extension, drought, fisheries, and water science including water quality, groundwater and sustainable water allocation), Manitoba Conservation and Climate (drainage and water use licensing, Environment Act licensing, drinking water). Other provincial departments including Municipal Relations (the Manitoba Water Services Board which assists municipalities with the development of sustainable water and wastewater works, and Community Planning which assists municipalities and planning districts in developing sustainable land use and development plan policies) and Indigenous and Northern Relations (provision of water and wastewater services to northern communities) also play a role in water and its management in Manitoba.

Municipal Government- have a role in water management in southern Manitoba. Municipal governments build and maintain water infrastructure including drainage works and water and wastewater treatment facilities. Some municipal governments are members of water co-operatives that supply water for drinking and other uses (for example, the Pembina Valley Water Co-op). Municipal governments are also the main partner in Watershed Districts, which are at

their core provincial and municipal collaborations to deliver water stewardship programs. Most of Manitoba's municipalities, (104 of 137 as of January 1, 2020) are partners in the Watershed District Program and with the modernization of the program, interest from the remaining municipalities is growing.

Conservation Organizations- Are interested in preserving the natural features of the area, and for the Boyne River, promote the recreational use of the river.

Community at Large- The farm site boundaries border neighboring farms and residences of the area. Residents of Carman, MB and surrounding area use the Boyne River for recreational use (skating, fishing, paddling). In addition, much of the catchment relies on the Stephenfield Lake Reservoir for potable water, which is also the major source of water for the site. Residents of these communities could potentially experience a number of local-scale primary impacts of the project, such as improved air and water quality, lowered costs of waste treatment, storm protection and water infrastructure maintenance.

Watershed District-The district's role is to protect, restore and manage water resources on a watershed basis. For example, one farm is working with RBWD to access cost sharing programs for cover crop and regenerative agriculture projects. All four farms are currently accessing or have accessed cost sharing programs in the past through the Water Districts (Redboine and Central Assiniboine). Projects include cover crop funding, shelterbelt restoration, and funding for soil sampling for variable rate fertilizer applications.

Water Authority- Offers a regional approach to producing and distributing high quality, potable water. The Pembina Valley WC pipeline distribution system covers a service area of 9,000 square kilometers and serves a population base of approximately 50,000 people. The PVWC is one of the major users of Stephenfield Lake Reservoir which is the also the major source of water for the farm.

Environment- Several of these agencies also represent the interest of the environment.

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). It is additionally 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 – The Stakeholders, Inputs, and Outputs

Stakeholders	Stakeholder Subgroup (if applicable)	Intended / Unintended Changes	Materiality of Changes to Stakeholder Group	Inputs	Value	Outputs
Environment	The environment is perceived as a stakeholder	Positive changes to various environmental parameters, especially biodiversity and habitat	Material- improved environmental conditions	Natural	Restored, preserved, conserved areas, biodiversity, and wildlife linkages	Enhanced environmental conditions
Agri-food supply chain companies		More sustainable and resilient supply chain	Material- positive return on investment, resilience	Funding, in-kind contributions	Dollar amounts	Positive return on investment
Community at Large	Surrounding and near the site	Enhanced regional characteristics (water, air, soil, economy and others)	Material- more opportunities, better quality of life	Support and participation	Financial, economic, social	Multiple benefits to the community reflected in various outcomes
Producers and Ag sector		Better agricultural opportunities, more sustainable regenerative practices	Material- economic implications	Labor and capital investment	Value of production of crops and other goods	More agricultural production
Government (local, state, Federal)	Includes water districts and authorities	Different agencies have varying expectations and can include water quality improvement, water balance, biodiversity, source water protection, cultural site protection, and others	Material- provides an opportunity for agencies to accomplish their respective missions	Technical support and public trust	In-kind	Enhanced environmental conditions, contributing towards agency missions

***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?

It is important to realize that the pilot project is focused on rotational crop producers implementing water stewardship practices to improve their water usage and contribute to enhancement of the watershed. The producers are following the process and setting goals in accordance with the AWS standard. The EcoMetrics analysis was focused on benefits stemming from these water stewardship practices, even if some of the benefits are not directly water related.

6.0 Analysis of outcomes

The following paragraphs describe anticipated changes experienced by stakeholders as they were described in the workshops, surveys, and one-on-one interviews.

6.1 Outcomes Expected by Stakeholders Engaged

Producers and Landowners

The four farms are the AWS standard implementing pilot sites. These farms will be implementing the water stewardship practices and will realize most directly the benefits stemming from the effort. Producers are also the ones making the primary investments necessary to implement the stewardship practices. Additionally, funding can be available from a variety of government programs (see below).

The producers ranked several key expected benefits that they would realize by implementing select water stewardship practices. The benefits considered were increased profitability, increased soil organic matter, water stewardship, reducing nutrient runoff, increased on-farm biodiversity, and reducing soil erosion. It is important to note that only 3 of the 4 producers responded to this survey. The producers also generally felt that implementing water stewardship practices and being more engaged with stakeholders and aware of the overall watershed characteristics will help them be more successful.

Producers decided which practices to implement based on the most important benefits expected. This is consistent with the AWS process that encourages implementers to employ practices that address the more important watershed challenges. Hence most planned practices are related to nutrient management, soil stability and health, and water use for irrigation, with activities related to ancillary land uses (riparian areas, wetlands, etc.) being of lower priority for implementation. The following figure maps the average scored priorities issues identified with the sustainable practices and associated benefit creation or preservation.

It is also important to see that different actions generate different outcomes, and those outcomes affect different groups of stakeholders. Figure 3 maps the priorities raised with the ultimate outcomes and beneficiaries of the outcome (if positive impact is created). For example, producers ranked “vulnerability to extreme natural events” as a relatively high priority concern. If an action taken is to restore and conserve natural riparian areas and wetlands, there would be a number of benefits beyond just flooding protection (such as biodiversity and habitat, soil retention, etc.). The impact would be beyond just the producers and landowners and extend to the general public and surrounding environment.

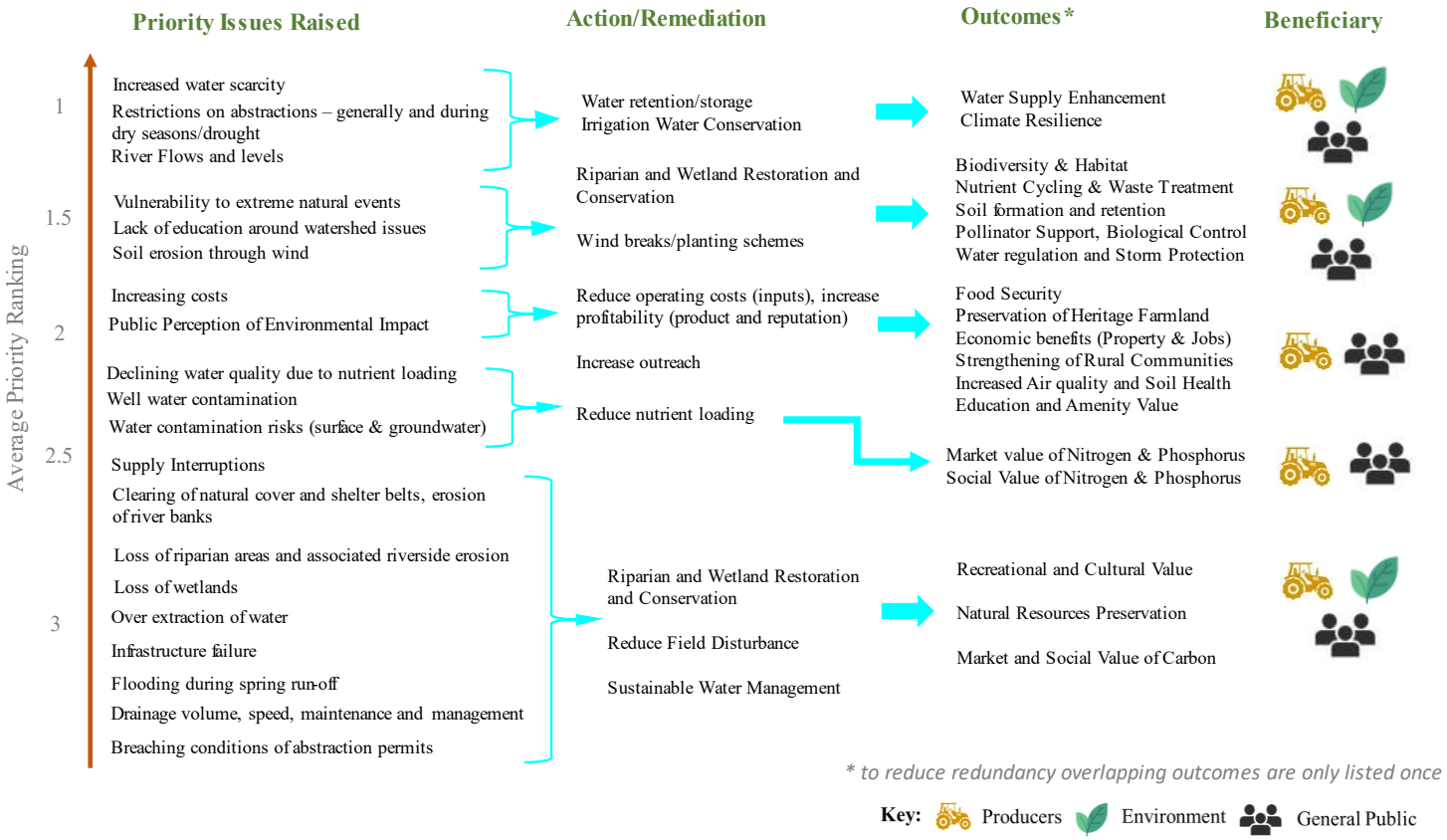

Figure 3: Priority Ranked Practices Mapped to Benefits

Agri-food Supply Chain Companies

The farms are suppliers to companies in the supply chain, and some of the companies are suppliers to the farms. These companies either provide products to the producers or are purchasers of crops that they then process for end customers. These companies expect to benefit as water efficiency and yields depending upon water supply are improved. By encouraging and supporting implementation of water stewardship practices, these companies will have a more resilient and reliable supply chain and at the same time be contributing to a healthier watershed. In the agriculture and food sectors, the resilience and performance of the supply chain, including the farms, can be as important, if not more, as the performance of the processing, packaging, and manufacturing steps of the value chain. Having a healthy agricultural economy, based on a dependable water supply, is a critical factor in siting new food processing and distribution infrastructure. Some of the companies have corporate sustainability goals for regenerative agriculture, water stewardship, or climate resiliency. Understanding which approaches are most effective helps to build the business case supporting the goals and their achievement. Participating companies expect that enhanced water performance by the farms will translate to improvement and efficiencies through the potato, grains, and oilseeds value chains. The pilot

farms in this project leading by example, and provide awareness, tools, and information to allow others to also do the same, thereby multiplying the impact.

Manitoba Provincial Government and Canadian Federal Government

The Provincial and Federal governments will benefit in that voluntary stewardship efforts such as this project improve the water balance and water quality in the watershed, thereby supporting their efforts. Because of the co-benefits identified in this EcoMetrics analysis, the Provincial and Federal governments will also see progress towards other goals, such as climate targets. In addition, the Provincial government has a higher likelihood of achieving their watershed-wide objectives. There may also be government grants and other funding programs available to the producers that could facilitate implementing practices, which in turn leads to meeting provincial goals.

Municipal Government

The municipal governments will benefit from the project by having a more stable and resilient water supply in regard to quantity and quality, as well as reduced infrastructure and damage due to flooding event costs. The local government will also benefit from the agriculture economy that provides a tax base and jobs, as well as indirectly benefiting other businesses in the municipality.

Conservation Organizations

This group was represented by the River Keepers, and their primary expectation is that the watershed and river can be maintained for recreation.

Communities surrounding and near the farms

Communities will benefit from improved air quality as a result of low disturbance farm practices, the preservation of rural cultural heritage and the social costs avoided of potential high nutrient loads in their waterways.

Watershed Districts and Water Authority

Watershed districts and authorities expect to benefit from the project by working more collaboratively with the producers. This will allow agriculture to continue and succeed without putting undue pressure on other elements of the watershed. For example, the Pembina Valley WC uses the same reservoir as one of the farms, and water stewardship efforts by that farm will directly benefit the authority.

The stakeholders interviewed in prior years as part of the water stewardship strategy development stated that whereas there is concern about agriculture's impact on the watershed, there is a recognition that agriculture is important to the economy, culture, and history of the area and should continue. In both the Boyne-Morris and Assiniboine watershed authority stakeholder meetings, feedback revealed that water supply and quantity were of paramount concern, followed closely by flooding and drainage control. Interestingly, agriculture-related water issues did not rank as high. Also noted of interest by stakeholders are riparian and wetland land cover types. As some of these land types also exist on the farms in the pilot, this AWS project could also contribute to benefits of interest to stakeholders. Specifically in regard to agriculture,

stakeholder envisioned that water stewardship practices on farms that save water, avoid contamination, and alleviate flooding and detrimental drainage would be beneficial. In general, the interplay of water, the natural environment, and successful rural economy are seen as key opportunities for watershed sustainability.

Environment

The most direct and documented benefits of water stewardship as noted by various stakeholders are water quality and quantity. These are predominantly associated with the enhancement of environmental functions, such as good water quality, flow regulation, and more indirect benefits such as climate and soil stabilization. Agricultural practices that enhance water stewardship also lead to enhanced ecosystem functions – such as nutrient cycling and biological control. Beyond this, carbon sequestration, and phosphorous and nitrogen capture are several of the critical outcomes of the project that are beneficial to the Environment. These environmental impacts are those that are recognized by the scientific community although the benefits may not be immediately recognized by local stakeholders. In some cases, these benefits may not manifest in ways identifiable by community residents until some point in the future. As the only stakeholder group that cannot speak for itself, the Environment is unique in that its outcomes were predominately articulated by scientific research conducted by EcoMetrics LLC, proxy stakeholders, and secondary literature.

7.0 Analysis Results

7.1 EcoMetrics Approach to Benefits Analysis

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. In EcoMetrics, we divided the SROI Map into four stages. Figure 4 is a conceptual flow diagram illustrating the SROI Mapping process.

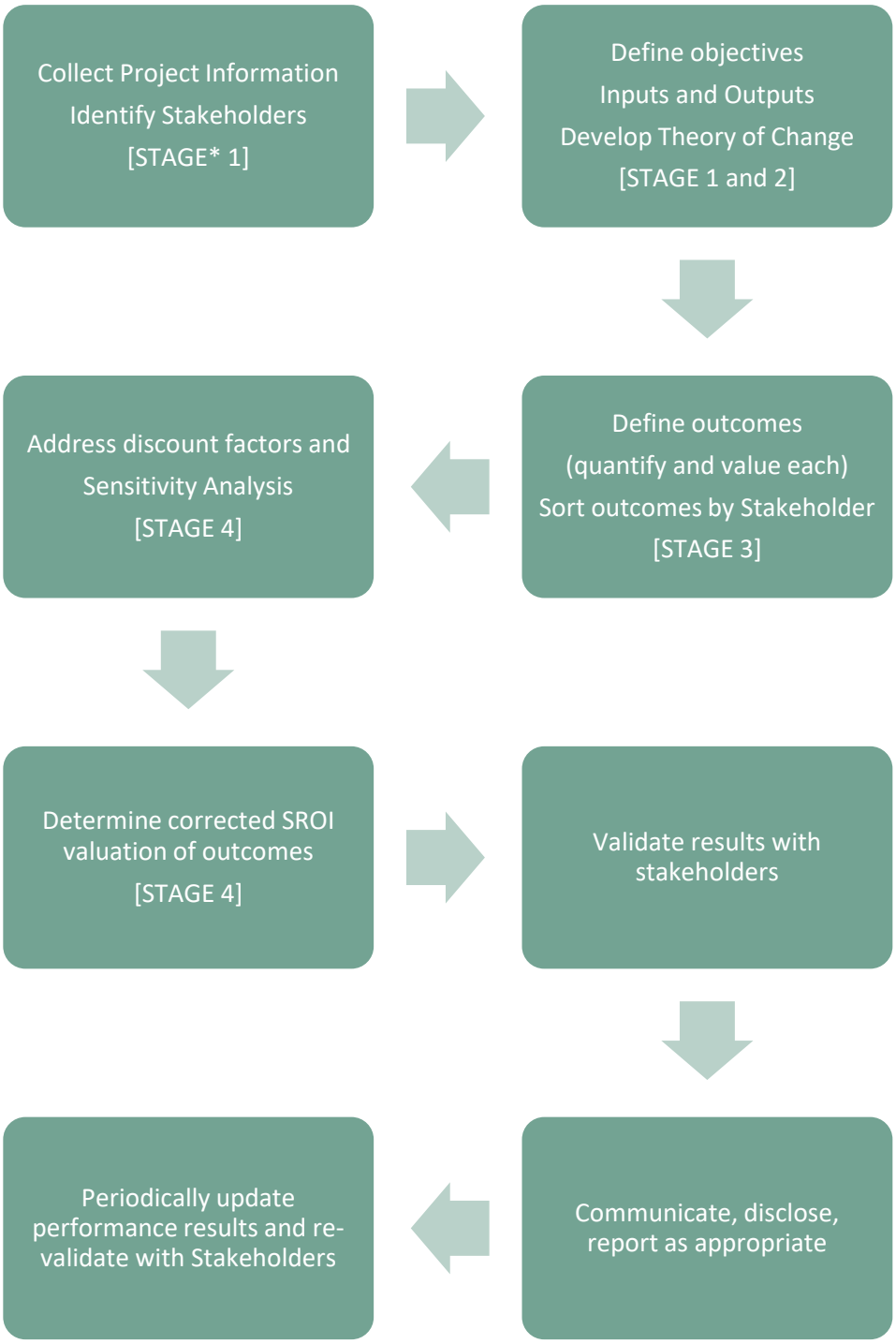

Figure 4: Conceptual SROI Mapping Flow Diagram

7.2 Inputs and Outputs- SROI Map Stages 1 and 2

The critical input included in this project is direct financial investment by Producers to implement water stewardship practices. As described above, Table 5 reflects Stages 1 and 2 and represents the specific stakeholder types, and how they relate to inputs and expected outputs. These outputs lead to the impacts, which include benefits, to be attributed to the stakeholders.

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

Once we know the outputs, we can determine what changes 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 also explained in Table 6.

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, we have assigned each outcome to the primary beneficiary, or in the case of some outcomes, to primary two stakeholder groups that benefit. Figure 3 (Section 6) depicts this overlap across stakeholder groups for a several selected outcomes. 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, we have organized these outcomes by stakeholder to address SVI principles.

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 or land uses are assigned all benefits, and some land types may have higher values for certain benefits as compared to others. These proxy values are often assessed on an annual “per acre” value basis. Non-acre values assessed, though fewer, were done as “per farm”, “per resident” or “per household” also on an annual basis, in this case.

Table 6: Outcomes by Stakeholder

Stakeholder	Outcomes	Outcome Description	Value Calculation (adjusted for NPV in every case)
Environment & Producers	Soil Formation	Accumulating soils (e.g., via plant matter decomposition or sediment deposition in riparian/coastal systems) for agricultural and ecosystem integrity	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Soil Stabilization	Retaining arable land, slope stability, and coastal integrity, erosion control	Erosion rate per year is multiplied by the social cost per ton sediment released, then multiplied by number acres over the lifetime of the project
	Biological Control	Providing pest, weed, and disease control	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Habitat and Biodiversity	Providing shelter, promoting growth of species, and maintaining biological diversity. Includes plant nursery services	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Nutrient Cycling	Storage, internal cycling, processing, and acquisition of nutrients, primarily for soil fertility	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Water Filtration	Removing water pollutants via soil filtration and transformation by vegetation and microbial communities	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Water Regulation	Regulating the rate of water flow through an environment and ensuring adequate water availability for all water applications	Number acres is multiplied by the value per acre per year, over the lifetime of the project
General Public	Climate Regulation	Supporting a stable climate at global and local levels through carbon sequestration and other processes	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Air Quality - Other GHG	Providing clean, breathable air by the removal of other GHG pollutants such as nitrogen dioxide, sulfur dioxide and ozone	Number acres is multiplied by the value per acre per year, over the lifetime of the project.
	Air Quality - Dust Particulates	Agricultural operations and field disturbance can generate and contribute to high levels of particulate matter air pollution, and generate a social cost that includes welfare, morbidity and economic losses	Dust released from ag operations is multiplied by the impact per person, times the number of people exposed, then halved to represent the decrease in practices (multiplied by project lifetime years)
	Air Quality - Equipment Emissions	The use of diesel fuel for farming equipment during field operations can be a hefty contributor of GHG pollution. Due to the environmentally minded reduced disturbance methods deployed here, emissions are reduced	Tons per gallon diesel used is multiplied by the gallons reduced per acre and the social cost of carbon per ton, over the lifetime of the project
	Carbon sequestration-Social Value	The social cost of carbon is inclusive of various economic damages by carbon emissions, such as impacts on the	Tons of C per acre per year is multiplied by the number of acres and dollar per ton of carbon social

		environment, agriculture and human health	value, over the lifetime of the project
	Nitrogen Retention-Social Value	The social value of marginal N can be measured by the loss of tourism, infrastructure water treatment costs and health impacts.	kg of N per acre per year is multiplied by the number of acres and dollar per kg of nitrogen social value, over the lifetime of the project
	Phosphorus Retention-Social Value	The social value of marginal P can be measured by the loss of tourism, infrastructure water treatment costs and health impacts	kg of P per acre per year is multiplied by the number of acres and dollar per kg of phosphorus social value, over the lifetime of the project
	Cultural and Aesthetic Value	Providing opportunities for communities to use lands with spiritual, religious, and historic importance, as well as enjoying and appreciating the scenery, sounds, and smells of nature	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Food Provisioning	Producing crops, fish, game, and fruits	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Raw Materials	Providing fuel, fiber, fertilizer, minerals, and energy	Number acres is multiplied by the value per acre per year, over the lifetime of the project
Local Government	Enhancing Rural Community Resources	This represents the average annual property value and associated tax per farm that would be lost to rural communities and consequently impact community and municipal resources such as schools and medical centers	Average property value of farmland per acre is multiplied by the tax rate imposed in Manitoba and the number of acres, over the lifetime of the project
	Storm Flooding Protection	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Water Supply/Quantity	Providing long-term reserves of usable water via storage in lakes, ponds, aquifers, and soil moisture. For cropland, the cost of water is based on the energy costs required to groundwater well pumping, which is reduced by 25% in the sustainable scenario	Number acres is multiplied by the value per acre per year, over the lifetime of the project
Producers	Pollinator Population Support	Pollinating wild and domestic plant species via wind, insects, birds, or other animals, mainly for agriculture	Number acres is multiplied by the value per acre per year, over the lifetime of the project
	Soil Health	Soil compaction can severely impact farm productivity, increase erosion and degrade drainage. Producers may see this cost as a drop in production and associated profit as well as the cost required to remediate compaction	Avg farm profit per acre is reduced by the average percentage lost to soil compaction impacts, multiplied by the number of acres, over the lifetime of the project

	Increased Profitability of Sustainable Practices	By adopting sustainable practices, Producers can expect to see increased profitability as a result of growing consumer demand for environmentally mindful food products	Avg farm profit per acre is increased by the average percentage gained by adopting sustainable practices multiplied by the number of acres, over the lifetime of the project
	Reduction of Lake Eutrophication	This represents the willingness to pay of residents to prevent lake eutrophication by supporting farmer adoption of sustainable practices by way of tax increase	Willingness to pay by households in the immediate area (as defined by rural population density) is multiplied by the dollars per household per year, over the lifetime of the project

* *Select outcome descriptions adapted from Costanza, 1997& FEMA, 2022*

7.4 Valuing Outcomes- SROI Map Stage 3

The model presented here is a valuation of outcomes based on the adoption of various water stewardship action plans, which not only include direct water use or conservation, but broader actions such as natural land restoration, field disturbance and nutrient application practices. This is achieved with the utilization of available or derived financial proxies, as described below.

7.4.1 Financial Proxies

For attaching values to outcomes, we used a meta-analysis and benefits transfer approach. Our goal was to find the most up-to-date peer-reviewed materials to use for the calculation of financial proxies across outcomes. Where possible, we looked for the most regionally specific calculations beginning from local and regional information to the national level. Peer-reviewed figures from provincial agencies were prioritized, depending on dates they were produced. Where these criteria could not be met for peer-reviewed proxies, recent 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.

Proxies were adjusted, as needed, to standardize units, currency, and inflation. Other corrections made to proxies include adjustments for formula inputs such as population density, erosion and soil nutrient retention rates to align with the current project context. Carbon values were derived from methodologies for various land cover types. For example, soil carbon and carbon in agricultural settings have different per acre sequestration rates than for other types of aboveground biomass, such as riparian, wetland, or tree cover. To avoid potential double counting between similar or overlapping outcomes, a small selection of applied outcomes was corrected as well. If multiple proxies were deemed appropriate across different data sources for an outcome, an average was then computed and applied. The minimum and maximum values in the range of study data were then applied to the sensitivity analysis. As no detailed acreages were reported for the type of natural lands on each farm (only the total), a median value proxy was used for the dominant natural land types onsite (hedgerows, greenspace, riparian zones, and wetlands).

7.5 Testing Outcomes for Materiality

Outcomes are tested for materiality before being included in the final analysis. Figure 5 depicts the process of determining materiality and is based on relevance and significance. 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.

Depending on the stakeholder group, causality between the outcomes was determined based on stakeholder involvement and/or applicable third-party literature. All outcomes are relevant because they are directly linked to the water stewardship practices, as no other factors or inputs were determined to have caused any of the outcomes identified by stakeholder groups and third-party literature. In short, the first event in the chain of events is the identified water stewardship practice, to which all identified outcomes are directly linked. The EcoMetrics methodology considers all outcomes mentioned by a stakeholder as significant and relevant, that is, if it was articulated by a member of a stakeholder group during the qualitative phase of the research. 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. Table 10 reflects the materiality assessment for the outcomes.

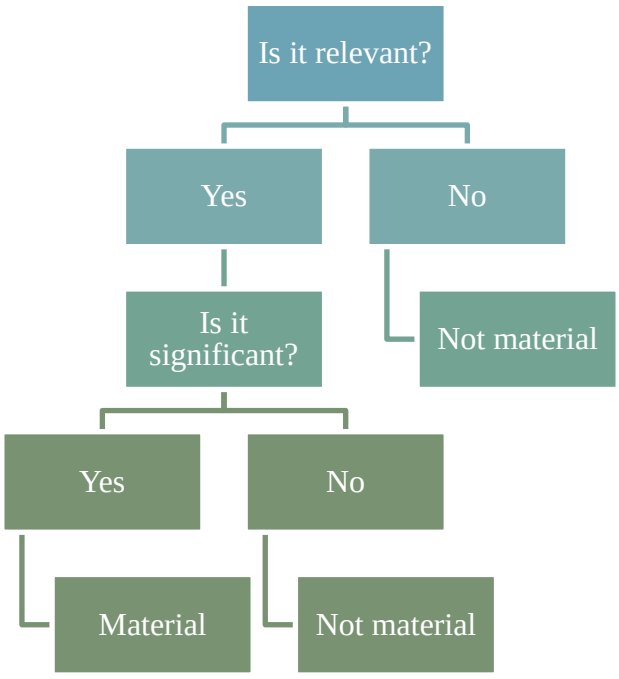

Figure 5: Determining Materiality Through Relevance and Significance

7.6 Analysis Results

The following tables show the results of the model for the composited four-farm analysis. The values are divided into two strategy categories

1. Adoption of cropland stewardship strategies: this includes improvements in nutrient management, water use and tillage on croplands
2. Enhancement of edge-of-field and marginal farmlands: this includes the restoration or preservation of
    a. critical riparian buffer zones (sensitive riverbanks)
    b. inland wetlands
    c. the plantings of hedgerows (to provide strategic windbreaks and pollinator habitats for nearby cropland)
    d. the preservation of rural green space (natural grasses and resilient vegetation land cover) on the farm property

The difference calculated shows the direction and magnitude of change between the two scenarios (baseline/current and full adoption of planned agricultural practices). We calculate a net value, thus negative values are seen for outcomes such as water quantity, soil erosion and those associated with nutrient application. Though both columns for any particular outcome may be negative, the delta yielded should be interpreted as an absolute value. For example, any farm practice will have relatively negative impacts on water use and soil erosion. However, the adoption of more sustainable practices can lessen that impact, yielding positive benefits based on units of water saved and sediment retained. These are relative valuations to existing practices. Table 7 shows the outcomes selected and how those values change according to current versus potential field practices over the next 25-years (assuming practices are deployed in Year 0).

This analysis does not include a detailed crop market analysis, employment values and the differences that may arise during crop rotation periods (see Section 8 for a discussion of crop-by-crop differences with regards to sustainability). Not only might the values change as more information is provided, but the overall list of outcomes may change as well once more information is incorporated into this model.

It is important to emphasize the heavy interplay of environmental and producer benefits. In this study, most benefits assigned to the Environment as a stakeholder, also directly benefits the Producer stakeholder group as well. A key finding of this study is that although natural lands represent a smaller proportion of the overall acreages in these properties, their inherent values are significant on a per acre basis. Thus, many successful sustainable approaches focus not only on cropland improvements, but also enhancing the entire agri-nature ecosystem. As mentioned in 6.1, actions on these non-crop lands were not flagged as a priority in the first iteration of water stewardship actions, but it was important to note that there is value potential.

All results presented here are in $CAD (2022) over the project lifetime with a 3% discount rate applied.

Table 7: Outcome Values by Stakeholder

Cropland Stewardship Strategies				
Stakeholder Group	**Outcome**	**Current**	**Stewardship Plan**	**Delta***
Environment & Producers	Soil Formation	$2,829,659	$2,829,659	$0
	Soil Stabilization	-$30,027,351	-$674,339	$29,353,012
	Biological Control	$18,049,378	$18,049,378	$0
Producers	Pollinator Population Support	$10,528,804	$12,527,422	$1,998,618
	Increased Profitability of Sustainable Practices	$0	$135,092,516	$135,092,516
	Reduction of Lake Eutrophication	$0	$1,639,869	$1,639,869
	Soil Health	$0	$14,191,764	$14,191,764
General Public	Air Quality - Dust Particulates	$0	$563,185	$563,185
	Air Quality - Equipment Emissions	$0	$1,325,544	$1,325,544
	Carbon sequestration- Social Value	$28,368,017	$59,785,233	$31,417,216
	Nitrogen Retention- Social Value	-$348,896,940	$305,372,433	$238,276,868
	Phosphorus Retention- Social Value	-$210,130,057	$625,883,464	$585,473,838
	Cultural and Aesthetic Value	$65,082,154	$65,082,154	$0
	Food Provisioning	$103,165,792	$103,592,726	$426,934
Local Governments	Enhancing Rural Community Resources	$1,035,710,097	$1,035,710,097	$0
	Storm Flooding Protection	$0	$771,403	$771,403
	Water Supply/Quantity	-$116,565,463	-$87,424,097	$29,141,366
	Total Social Value	**$558,114,090**	**$2,294,318,411**	**$1,069,672,132**
	TOTAL ($MM)	**$558.11**	**$2,294.32**	**$1,069.67**
Enhancement of edge-of-field and marginal farmlands				
Stakeholder Group	**Outcome**	**Current**	**Stewardship Plan**	**Delta**
Environment & Producers	Biological Control	$4,716,763	$6,289,018	$1,572,254
	Habitat and Biodiversity	$47,902,446	$63,869,928	$15,967,482
	Nutrient Cycling	$10,871,592	$14,495,456	$3,623,864
	Soil Formation	$66,000	$88,000	$22,000
	Soil Stabilization	$17,272,960	$23,030,613	$5,757,653
	Water Filtration	$98,217,901	$130,957,201	$32,739,300
	Water Regulation	$70,289,131	$93,718,841	$23,429,710
Producers	Pollinator Population Support	$10,247,314	$13,663,086	$3,415,771

General Public	Air Quality - Other GHG	$6,020,425	$8,027,234	$2,006,808
	Climate Regulation	$3,101,203	$4,134,937	$1,033,734
	Cultural and Aesthetic Value	$18,401,209	$24,534,945	$6,133,736
	Food Provisioning	$12,572,856	$16,763,808	$4,190,952
	Raw Materials	$8,002,030	$10,669,373	$2,667,343
Local Governments	Storm Flooding Protection	$88,552,092	$118,069,456	$29,517,364
	Water Supply/Quantity	$12,918,876	$17,225,168	$4,306,292
	TOTAL	**$409,152,798**	**$545,537,064**	**$136,384,263**
	TOTAL ($MM)	**$409.2**	**$545.5**	**$136.4**

** These figures are the processed valuations for each outcome over the entire project horizon (Year 0 (now) plus 25 years). A number of corrections were applied to these values in the analysis phase; thus, this table is not necessarily additive down the table rows and the delta is not reflective of a simple subtraction across the table columns. Please refer to Section 7.5 for detailed descriptions of the corrections applied*

The following chart (Figure 6) shows the distribution of value created across the different stakeholders identified in this stage of the study:

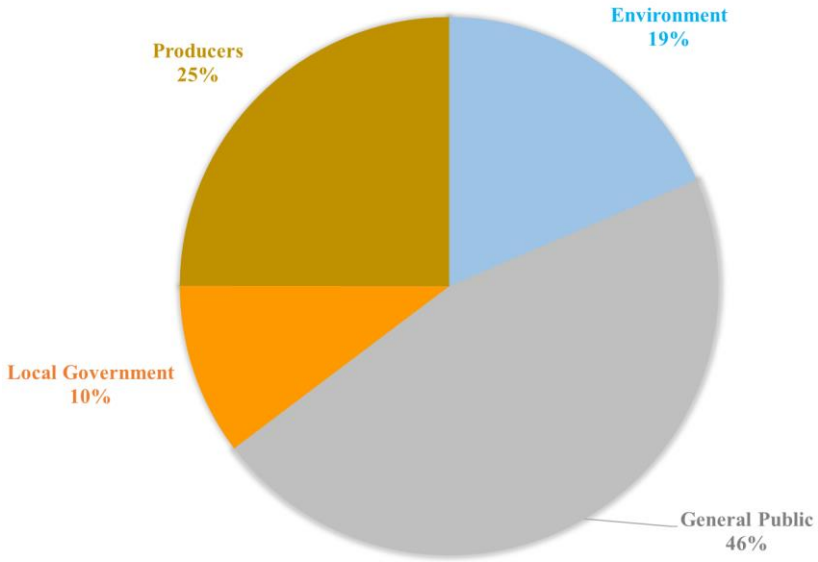

Figure 6: Distribution of Value by Stakeholder

Producers, along with the general public, benefit significantly from the adoption of planned agricultural practices. As producers are themselves community members, it could be seen that they also stand to benefit from nearly all the outcomes identified and valued in this study.

The following pie charts (Figures 7 and 8) show the relative contributions of each outcome to the total valuation, by strategy type.

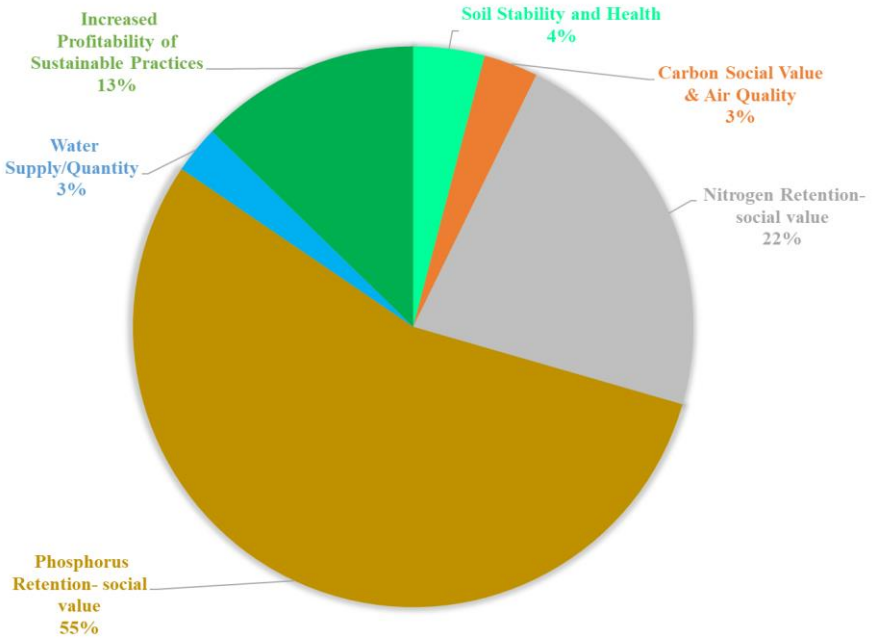

Figure 7: Relative contributions of outcomes in the cropland stewardship strategy

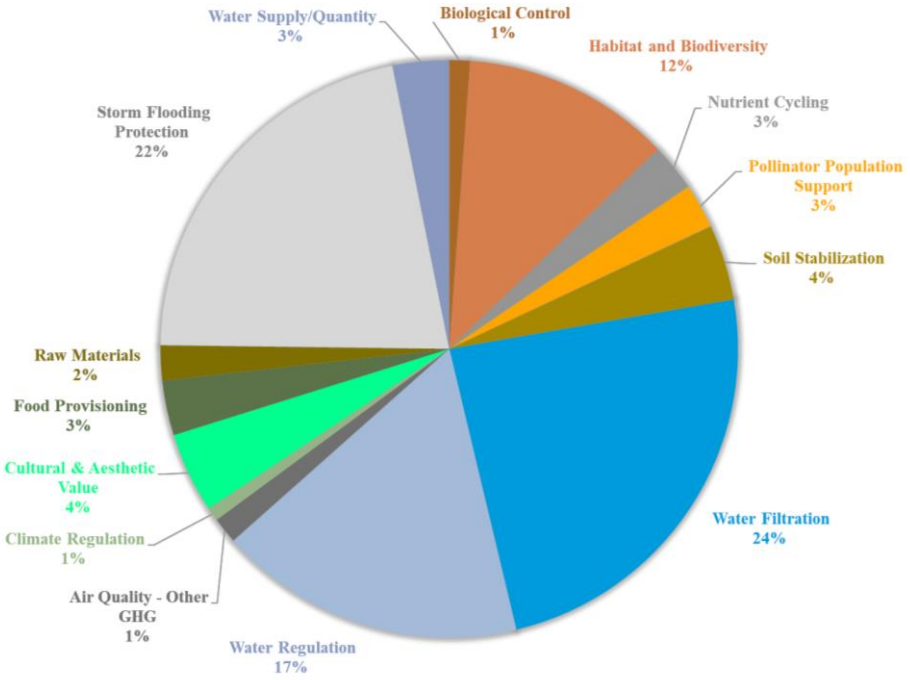

Figure 8: Relative contributions of outcomes in the Edge-of-Field and Marginal Farmlands Enhancement strategy

In the Cropland focused strategy scenario, the total value is primarily driven by the avoided social costs of phosphorus and nitrogen, making water quality improvements a key benefit of this strategy. The social costs of nitrogen and phosphorus pollution released into the environment can be derived in several ways. Many studies examine the cost to human health as a result of nutrient release, as well as its impact on tourism and associated economic losses (due to decreased recreation on waterways or water bodies as a result of eutrophication). Other methods look at the offset cost burden on local infrastructure to capture and treat elevated levels of nutrients in the water supply. For study areas that are more population dense, the cost on centralized wastewater treatment plants is often used. For this study, given the more rural context and high levels of runoff and potential flooding, the proxy used is based on the infrastructure cost to capture and treat contaminated storm run-off. Water conservation benefits could increase if the stewardship plans call for more aggressive conservation practices. In the Enhancement of edge-of-field and marginal farmlands scenario, the values are driven by water filtration, water regulation and storm flooding protection.

Table 8 shows how the adoption of different cropland or natural lands management activities can have very different Social Returns on Investment. The SROI is the return on investment, in other words it is a ratio of value created vs investment. In Table 12, under the Cropland Stewardship Strategy for example, 6.5 means 6.5 dollars of value is created for every dollar invested (6.5:1 as a ratio). The results further emphasize the benefits of taking an ecosystem level approach to achieving sustainability in agriculture.

The croplands column captures those activities related to producer activities related to growing their crops (water use, nutrient application, tillage, etc). The other three columns are related to the value associated with the "natural lands" element. In other words, those acres that are not in crop production. Results are separated by land cover type to reflect the inherent differences in values and management costs between land types. As we did not have exact acreages for each or know exactly what the producers are going to do with these lands, certain assumptions we made. In order to determine ROI, we need to know how much will be spent to generate the projected value created. As specific investment information was not available from the producers, these estimates are based on average costs to transition farm practices or restore natural lands. Typical expense estimates in these valuations include (but are not limited to) the cost of maintenance, monitoring, equipment costs, strategic planting, grading, drainage and so on. It is important to note that these values are supported by critical assumptions that could drive the estimated ROI in either direction. Some of these assumptions include:

- The level of degradation on the natural lands is not severe
- The level of capital investment required by producers is relatively modest (for example, this assumes that producers will not have to invest in very expensive heavy equipment up front and have reasonable amounts of weed management expenses)
- Land rentals or leases are not included if they exist
- Municipal grants to support these activities would likely decrease the investment cost and increase the ROI, but are not included here

Table 8: SROI of Sustainable Ag and Land Management Activities

	Cropland Stewardship Strategies	Wetlands Enhancement	Riparian Enhancement	Hedgerows & Greenspace Enhancement
Annualized Value per Acre	$1,103	$14,849	$37,845	$11,609
Annualized Capital Cost	$0.03	$524	$838	$263
Annualized Operating Cost	$148	$368	$260	$54
Net Valuation	$955	$13,957	$36,747	$11,291
SROI	**6.5:1**	**15.7:1**	**33.5:1**	**35.5:1**

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 the AWS standard pilot implementation project in southern Manitoba, Canada. In this analysis, integrated social value was quantified using the EcoMetrics model, 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.

The key questions the Project Partners wished to solve for with this work follow:

- What can be done to improve on-farm water stewardship outcomes?
- Which water stewardship interventions deliver the most value, and to whom?

To answer the first question, Project Partners used the AWS standard to develop Water Stewardship Plans. For the second question, the analysis shows that implementing water stewardship practices at the pilot farms will result in environmental, economic, and social benefits. Despite the environmental uncertainties that accompany any watershed-scale efforts project partners and stakeholders believe that investment will be of value to the producers as well as the community and watershed. The study also showed that water stewardship practices will not only have water-related benefit, but there are additional co-benefits in a number of other environmental, economic, and social categories. The quantification and valuation showed that those activities that were initially perceived to have the most important benefits, while still important, did not rank as high in terms of SROI. This knowledge may lead to future, more refined prioritization of intended practices.

In summary, the results show that the farms already bring value to the community under current operation. However, there is significant value to be gained by implementing the proposed water

stewardship practices. We also learn from the analysis that the water stewardship efforts with the highest SROI potential are those that enhance the edge-of-field and marginal farmlands. Because both cropland and edge-of-field and marginal farmland practices both bring value, it is important to implement a combination of cropland stewardship practices and stewardship of the edge-of-field and marginal farmlands that exist on the farms in an ecosystem level approach to achieving sustainability in agriculture. Finally, we note that even though the practices are driven by water stewardship commitments, they provide benefits in many other categories and to many other stakeholders, beyond the producers.

8.2 Recommendations

Based on the analysis and findings, the following actions in regard to the EcoMetrics analysis are recommended:

- *Continued stakeholder engagement.* This SROI analysis has demonstrated the value of formally engaging with local and regional community members who are potentially going to be impacted by the project. The purpose of this engagement is to understand from their perspective what will change and how they value that change. To establish the long-term impact of the project on these local and regional stakeholders, the Producers should continue to stay engaged with stakeholders as the project progresses and repeat the stakeholder engagement in the future.
    - Identify and engage stakeholders from groups identified as possible beneficiaries but who did not yet exist at the time of this predictive analysis
    - Enlarge the sampling size of stakeholders
- *Communicate the impact.* The analysis reveals several impacts that water stewardship can have locally and regionally. Many of these impacts may be readily apparent to local stakeholders, such as the physical alteration of the landscape while other impacts, such as the management of carbon, phosphorus, and nitrogen, may be less apparent.
- *Measure the outcomes of the project.* Use the methodology and lessons learned from this analysis to monitor the outcomes of the project, using the theory of change as the framework from which to identify expected and unexpected outcomes. Producers should engage with stakeholders at the start of the project and at regular intervals to understand the social value creation process over time.

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Appendix II – Producer Survey

Farmer Project Evaluation Questionnaire

This questionnaire is intended to evaluate your experience going through Steps 1 & 2 (information gathering and water stewardship planning) of the Alliance for Water Stewardship Standard process. Your feedback will help us understand what you, as a producer, found valuable and help support future water stewardship projects.

1. Briefly explain your reason(s) for taking part in the Lake Winnipeg Basin Project.

2. What does the term water stewardship mean to you and your farm?

3. Rate the extent to which this project has improved your awareness of watershed issues that surround your farm. Note that the term "watershed issues" refers to issues that impact water quantity and quality throughout the region of land surrounding your farm boundaries that drains or sheds water into a specific receiving waterbody. An example of a watershed would be the Boyne-Morris Watershed which encompasses the area of land that contributes water to the Boyne and Morris Rivers including tributaries such as the Roseisle, Tobacco, and Shannon Creeks. (Circle letter of your answer.)

a. Very low improvement

b. Low improvement

c. Medium improvement

d. Strong improvement

e. Very strong improvement

4. Please comment on how your farms knowledge of watershed issues has changed over the course of the project.

5. Rate the priority your farm will place on engaging with important stakeholders on watershed issues in the future. Note that "important stakeholders" refers to any organization, group or individual that has some interest or 'stake' in implementing your organization's water-related activities, and that can affect or be affected by them. (Circle letter of your answer.)

a. Very low priority

b. Low priority

c. Medium priority

d. High priority

e. Very high priority

6. Please comment on aspects of the project that have influenced/changed your farms approach to engaging with important stakeholders on watershed issues in the future.

7. Rate how the project has changed your farms approach to managing the following? (Circle number of your answer.)

	Very unchanged					**Highly changed**
a. Tillage	1	2	3	4	5	6
b. Nutrient management	1	2	3	4	5	6
c. Water management	1	2	3	4	5	6
d. Riparian areas (eg., native habitat)	1	2	3	4	5	6

8. Please comment on aspects of the project that have influenced/changed your farms approach to managing tillage.

9. Please comment on aspects of the project that have influenced/changed your farms approach to nutrient management.

10. Please comment on aspects of the project that have influenced/changed your farms approach to managing water for irrigation.

11. Please comment on aspects of the project that have influenced/changed your farms approach to managing riparian areas.

12. Rate which outcomes are most important to decision making on your farm (Circle number of your answer.)

	Very unimportant					**Highly important**
a. Increased profitability	1	2	3	4	5	6
b. Increased Soil organic matter	1	2	3	4	5	6
c. Water stewardship	1	2	3	4	5	6
d. Reducing phosphorous run-off	1	2	3	4	5	6
e. Increased on-farm biodiversity	1	2	3	4	5	6
f. Reducing soil erosion (wind & water)	1	2	3	4	5	6

13. In the past, have you invested in water stewardship activities? Please provide detail regarding any past investment in water stewardship related projects.

14. Would you invest time and money in the areas of change that have been identified through this project ie., objectives identified in the water stewardship plans?

15. Would you recommend the water stewardship planning process to your peers?

16. Do you have any suggestions for the future of this project?

17. So far, what aspects of the project have you found valuable?

18. So far, what aspects of the project have you not found valuable?

19. We are interested in any other comments you might have regarding your experience throughout the Lake Winnipeg Basin Project. Please write in the space below any thoughts you'd like to share with us