



PROGRESS REPORT:
RESULTS OF CONSULTATION WORKSHOP

FOR
WETLANDS CONSERVATION & RESTORATION
PROTOCOL

TO:
CLIMATE CHANGE CENTRAL
&
DUCKS UNLIMITED CANADA

30 APRIL 2010

Contents

1	Executive Summary	3
2	Introduction	3
3	Protocol Development Process — Progress to Date	5
3.1	Background	5
3.1.1	Canada’s National Inventory Report — Country-specific Quantification Methodology	5
3.1.2	Agriculture and Wetlands Greenhouse Gas Initiative (AWGI)	5
3.1.3	ISO 14064-2 Standard and Alberta Offset System	6
3.2	Technical Background Document	6
3.3	Science Discussion Document 1 - Implementation	6
3.3.1	Scope	7
3.4	Science Discussion Document 2 - Quantification	11
3.4.1	Scope	12
3.4.2	Delineation and Monitoring of Wetlands & Uplands in Baseline and Project	13
3.5	Consultation Workshop	13
3.5.1	Names, Affiliations, and Roles of Participants in the Consultation Workshop	13
3.5.2	Decisions of the Consultation Workshop	14
4	Protocol Development Process — Preparation of Technical Seed Document	20
4.1	Issues arising from Polling at the Consultation Workshop	20
4.2	Issues arising from Discussion at the Consultation Workshop	22
5	Outline of Remaining Process for Approval in Alberta Offset System	22
6	References	23
	Appendix A – Proposed Project and Baseline SSs	27
	Appendix B – Relevant SSs	34

1 Executive Summary

This Consultation Report describes the development to date of the Wetlands Conservation & Restoration Protocol (“**Wetlands Protocol**”). The process for development includes two Science Discussion documents – one focussed on Quantification and one on Implementation – as well as a Consultation Workshop.

Following the decisions of the Consultation Workshop, the main elements of the Wetlands Protocol are determined. The eligibility requirements of the Wetlands Protocol are designed according to the criteria of the Alberta Offsets System and Canada’s Offset System.

2 Introduction

Climate Change Central is coordinating protocol development and review on behalf of the Ducks Unlimited Canada and the Prairie Habitat Joint Venture. These organizations have initiated the Wetlands Restoration and Conservation Protocol work to develop a protocol quantifying the conservation and restoration of wetlands in the Prairie Pothole Region of Alberta. The workshop gathered experts to review and assess the science, methods and elements of these protocols for their applicability to prairie conditions.

ClimateCHECK, in collaboration with a Technical Working Group prepared two Science Discussion Documents to lead the discussion. The group wishes to bring forward a protocol, based on the best available science on GHG emission reductions from wetlands management in the Prairies, and potentially for the rest of Canada, to the Alberta Protocol Development Process. The protocol development follows the established process for coordinating scientific information and consensus-building according to the ISO 14064-2 GHG Project-Based Standard.

The purpose of the workshop was to engage key scientific researchers, technical experts and project developers at home and abroad, to provide advice and agreement on the best available quantification methodologies to assess GHG emissions.

The general process followed during the Consultation Workshop can be summarized as follows:

- ✓ Use a combination of a literature and existing protocol review in the form of a science discussion papers, share recent research results, researcher experience and group discussion and evaluation of ideas and recommendations to achieve the workshop outcomes.
- ✓ The first day was spent setting the foundation by setting the context for carbon offsets and protocols, examining the state of the science and baselines; the quantification approaches and coming to consensus the framework of the protocol; the second was focus on identifying and addressing quantification and implementation issues as well as identifying science gaps for future research.

The development of the Wetlands Protocol is guided and reviewed by a Technical Working Group, comprised of the following individuals:

Name	Affiliation	Role in Working Group
Cynthia Edwards	Ducks Unlimited Canada	Technical Lead
Tanya Maynes	Climate Change Central	Project Coordinator
Pascal Badiou	Ducks Unlimited Canada	Working Group Member

Rick Bourbonniere	Environment Canada	Working Group Member
Tom Goddard	Alberta Agriculture and Rural Development	Working Group Member
Bob MacFarlane	Prairie Habitat Joint Venture	Working Group Member
Leslie Wetter	Ducks Unlimited Canada	Working Group Member
Rob Janzen	ClimateCHECK	Lead Consultant

This Consultation Workshop Report summarizes the results of the workshop and identifying consensus decisions made and sciences gaps remaining to be addressed before starting the protocol development process.

3 Protocol Development Process — Progress to Date

3.1 Background

3.1.1 Canada's National Inventory Report — Country-specific Quantification Methodology

Canada's National Inventory Report relies on International Panel for Climate Change (IPCC) guidance, and in some cases refines IPCC coefficients and factors using country-specific data and expert judgment. To date, IPCC has not published guidance concerning GHG emissions from conserved and restored wetlands and Canada's National Inventory Report does not address this kind of land use change.

Wetlands are addressed under the Land Use, Land Use Change and Forestry (LULUCF) section in Canada's National Inventory Report. The LULUCF Sector addresses GHG fluxes between the atmosphere and Canada's managed lands, as well as those associated with land-use changes. A LULUCF assessment includes emissions and removals of CO₂, and additional emissions of CH₄ and N₂O following land conversion to cropland.

In this regard, wetlands are addressed within the LULUCF framework in terms of emissions changes when wetlands remain wetlands and when land is converted to wetlands. Within the LULUCF framework, wetlands are described as "areas where permanent or recurrent saturated conditions allow the establishment of vegetation and soil development typical of these conditions and that are not already in forest land, cropland, or agricultural grasslands".

Given that wetlands within the Prairie Pothole Region of Canada are either drained for cropland use, or exist in their natural state (not considered a peatland, and only flooded for parts of the year), a quantification approach is needed to address the unique physiological characteristics of these mineral wetlands. The IPCC, which guides the development of Canada's National Inventory Report, notes that restoration of wetlands is becoming a more prevalent land management change. But, in the most recent IPCC guidelines, this activity is set aside for 'future methodological development'.

Although Canada's National Inventory report should be consulted and considered when developing GHG quantification guidelines and programs in Canada, it relies on IPCC guidance, and therefore does not appear to address wetland conservation and restoration activities in the specialized manner needed for development of a Wetlands Protocol. It is important to note current land-based quantification protocols approved for the Alberta Offset System, and those submitted for initial consideration to Canada's Offset System, use factors and equations derived by scientists responsible to populate Canada's National Inventory Report.

3.1.2 Agriculture and Wetlands Greenhouse Gas Initiative (AWGI)

A significant and ongoing research program pertinent to the quantification of GHG emissions and potential GHG reductions in wetlands of Canada is the Agriculture and Wetlands Greenhouse Gas Initiative (AWGI). Major funding for this initiative is provided by Agriculture and Agri-Food Canada, Environment Canada, Natural Resources Canada, Ducks Unlimited Canada, and Natural Resources Engineering Research Council of Canada/BIOCAP Strategic Grant. This project uses a landscape approach to examine the functional linkages between prairie wetlands, riparian areas and their adjacent agricultural fields in terms of carbon sequestration and greenhouse gas (GHG) flux. As the AWGI project was completed in 2009, few of the research results have been published as yet in the peer-reviewed literature.

3.1.3 ISO 14064-2 Standard and Alberta Offset System

The ISO 14064-2 standard (2006, Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements) is the framework for protocols in the Alberta Offsets System and in the proposed Canada's Offset System, as well as in a number of US programs (Voluntary Carbon Standard, GE-AES GGS, CAR, RGGI, etc.).

The objective of the Discussion Documents, therefore, was to compile the relevant scientific information, within the discipline of ISO 14064-2, to quantify GHG emissions reductions associated with conservation and restoration of wetlands in the Prairie Pothole Region of Canada for review at the Consultation Workshop to achieve consensus for the continuing design and development of the Wetlands Conservation and Restoration Protocol.

3.2 Technical Background Document

Timeline — July 2008 to November 2008

A Technical Background Document was compiled by ClimateCHECK in collaboration with the Technical Working Group. The issues addressed in the Technical Background Document were developed more comprehensively in the Science Discussion Documents, so the content of the Technical Background Document is not described in this Consultation Workshop Report.

The Technical Background Document concluded “the existing data and discussions within the scientific community appear to support the consensus of opinion that conserved or restored wetlands Prairie Pothole Region represent net GHG sinks. However, this consensus also supports an emphasis that site-specific factors must be controlled to limit positive GHG flux from conserved and restored wetlands.”

An important outcome of the Technical Background Document was the understanding that Canada's National GHG Inventory Report does not provide a method to quantify net reductions from conservation and restoration of wetlands in the Prairie Pothole Region. This outcome created a challenge for the development of the proposed Wetlands Protocol; namely, to develop a quantification and implementation approach at a high level of credibility, but sensitive to the site-specific factors governing net GHG dynamics in the wetlands of the Prairie Pothole Region.

3.3 Science Discussion Document 1 - Implementation

Timeline — April 2009 to March 2010

In protocol development efforts under the defunct National Offsets Quantification Team process and within the required process for protocol approval of the Alberta Offsets System, the policy or implementation requirements as well as the science or quantification requirements of a protocol are discussed in a single Science Discussion Document. However, the Phase 1 efforts for the development of the proposed Wetlands Protocol determined the need for separate Discussion Documents for the implementation and quantification components. The main reason for this separation is the unusually complex nature of the development effort required for the quantification component for the proposed Wetlands Protocol. That is, since no quantification approach for wetlands conservation and restoration is included in Canada's National Inventory Report, the Wetlands Protocol quantification approach must be developed on the basis of research data and expert judgment.

The policy pertinent to GHG reductions associated with land use change and avoided land use change is evolving. Therefore, the Implementation Discussion Document focused on supporting consensus among policy decision-makers and technical experts concerning issues of additionality or incrementality, permanence, and leakage. These issues were addressed in the context of global GHG programs, and were ultimately structured according to principles in compliance with the emission reductions criteria of ISO 14064-based North American GHG programs.

PRINCIPLE At the Consultation Workshop, consensus will be sought for each Decision Point. Decision Points receiving a consensus opinion, defined as 80% agreement among designated scientific participants, will be the foundation for further development of the Implementation element of the Wetlands Protocol. The ‘agreement’ score is the sum of the “Accept’ and ‘Accept with more work’ categories. Thus, the Workshop is designed to serve as ‘in-person peer review’, where the collective experience and expertise of the designated qualified participants is the authority for decisions. Usually, this will mean the participants will be asked to interpret and apply evidence presented in the peer-reviewed literature. But, in some instances the designated qualified participants will be asked to use their judgment to fill gaps in the published literature.

3.3.1 Scope

In the Implementation Discussion Document, discussion concerning the scope of the Wetlands Protocol pertained to (1) definition and delineation of prairie pothole region wetlands, (2) protocol development context, (3) determination of the appropriate scope of the Wetlands Protocol, (4) baseline selection, (5) additionality or incrementality, and (6) ownership, permanence & leakage.

3.3.1.1 Definition and Delineation of Prairie Pothole Region Wetlands

The Implementation Discussion Document noted that among the wetlands of the world, the wetlands of the Prairie Pothole Region have unusual characteristics of biology, biogeochemistry, hydrology, and hydrogeology. The Implementation Discussion Document therefore presented several sources of terms and standards of practice are pertinent to delineate and describe the wetlands of the Prairie Pothole Region, including Stewart and Kantrud (1971); Corps of Engineers (1987); Gleason et al. 2008; U.S. Fish and Wildlife Service and Canadian Wildlife Service (1987) and Turner et al. (1987), Bartzen (2008); and Alberta Environment.

The Implementation Discussion Document proposed the following decision points for the workshop regarding the definition and delineation of Prairie Pothole Region wetlands:

- The wetland basin will be defined as the area extending from the centre of the wetland to the outer edge of the wet meadow zone.
- The wetland margin will be defined as the area extending 10 m from the centre the outer edge of the wetland basin
- The wetland will be defined to include the area of the wetland basin and wetland margin
- The upland will be defined as the area contributing surface runoff to the wetland zone and is composed of three subzones based on landscape position: shoulder-slope, mid-slope, and toe-slope
- The proposed Wetland Protocol will use the definition of wetland loss from Alberta Environment: “Wetland loss — includes infilling, altering, or physically draining the wetland, any impact to the riparian area and buffers strips, and any type of interference with the hydrology to

and from the wetland”. In the proposed Wetland Protocol, then, wetland loss is interpreted to involve any transitory or permanent degradation to the wetland or upland.

- The procedures, systems, and controls used by Ducks Unlimited in wetland conservation and restoration projects in the Prairie Pothole Region of Canada should be used as the frame of reference to finalize the wetland delineation approach for the proposed Wetlands Protocol. It is expected that the delineation will be consistent with the “Standard Operating Procedures for Aerial Waterfowl Breeding Ground Population and Habitat Surveys in North America”, as described in the sample inspection report from Turner et al. (1987)
- A Qualified Wetland Aquatic Environment Specialist should be required to approve the delineation of wetlands included in all projects under the proposed Wetlands Protocol.

3.3.1.2 Protocol Development Context

In the absence of protocols pertaining to wetlands conservation and restoration approved in other GHG programs, the Implementation Discussion Document reviewed general GHG policy and specific practice concerning wetland conservation and restoration for adaptation as guidance in the development of the proposed Wetlands Protocol. The GHG policy context included post-Bali UNFCCC, Compliance Markets in Canada and the United States, the Voluntary Carbon Standard (VCS), the Offset Quality Initiative, and the Ducks Unlimited Inc. Avoided Grassland Conversion Project. Practices reviewed included Alberta and Canadian wetlands management policies, as well as other current wetland conservation and restoration activities and initiatives.

Based on the review, the Implementation Discussion Document proposed the following decision points for the workshop regarding the protocol development context:

- The premise of the Wetlands Conservation and Restoration Protocol is consistent in logic with recent policy developments in compliance and voluntary GHG programs across the world
- The existing policy and practice concerning wetland mitigation in the Prairie Pothole Region allows the development of a GHG quantification protocol to create real and verifiable offsets
- Regardless of the emerging context to support development of a Wetlands Protocol, it is clear the proposed Wetlands Protocol is innovative. This means development of this protocol will require extraordinary commitment of time, talent, and resources

3.3.1.3 Determination of Appropriate Scope

The discussion of the Implementation component of the appropriate scope of the Wetlands Protocol involved consideration of two issues: first, the issue of whether to include both conserved and restored wetlands within the Protocol (i.e., eligible categories); and second, the boundary of the Protocol.

In order for both conservation and restoration of wetlands to be eligible categories that accrue additional or incremental reductions and removals of GHGs, it is necessary to demonstrate that pristine wetlands continue to be drained or degraded and that drained wetlands are remaining under alternative land use. The following decision point for the workshop regarding eligible categories was therefore proposed:

- Such a large proportion of wetlands and associated uplands in the Prairie Pothole Region of Canada have been degraded as a result of landscape alteration that it is reasonable to assert the vast majority wetlands in this region are subject to wetland loss.

With respect to boundaries, the Implementation Discussion Document noted that consensus will need to be found at the workshop concerning whether the proposed protocol needs to address management of soil, plants, and nutrients on land surrounding the wetlands. Consistent with the definition of wetland, the scope of the proposed Wetlands Protocol could be designed to accommodate the inter-relatedness of upland management and wetland GHG emissions and reductions. Based on this, the following decision points for the workshop regarding boundaries were proposed:

- Conservation will include activity to reverse wetland loss as a result of transitory impacts (Turner et al. 1987). Thus, conservation activity involves:
 - (1) Termination of burning, clearing, and cultivating of the wetland margin; and
 - (2) Managed grazing and haying in the wetland margin, and
 - (3) Improvement of management of the associated upland.
- In the proposed Wetlands Protocol, restoration will include activity to reverse wetland loss as a result of permanent impacts (Turner et al. 1987). Thus, restoration activity involves:
 - (1) All activity prescribed for conservation; and
 - (2) Reversal of drainage and filling.
- Improved management of associated uplands as prescribed under conservation activity should require these uplands to be managed according to approved GHG reduction protocols appropriate for the upland land use. For example, associated cropland could be managed according to the practices prescribed by the Tillage System Management Protocol and the forthcoming Nitrous Oxide Emission Reduction Protocol. Or, associated grassland should be managed according to a specified grassland management protocol.
- The proposed Wetlands Protocol should be designed to allow project proponents to use complementary protocols to generate GHG reductions and removals in the wetland margin and associated upland.

3.3.1.4 Baseline Selection

Concerning the implementation component of the baseline selection, the Implementation Discussion Document reviewed two elements. First, different approaches to selecting a baseline scenario were identified, including Historic Benchmark, Performance Standard, Comparison-based, and Projection-based approaches. Based on this review, the following decision points for the workshop regarding baseline scenarios were proposed:

- The historic benchmark approach is the most suitable approach for determination of the baseline for the proposed Wetland Protocol.
- The performance standard approach is the most suitable approach for determination of the baseline for the proposed Wetland Protocol.
- The projection-based approach is the most suitable approach for determination of the baseline for the proposed Wetland Protocol.

Second, what would have happened to the wetland if not conservation or restoration project were originated under the proposed Wetlands Protocol was defined. The Implementation Discussion Document noted that no regulations exist in Canada to protect wetlands from drainage or degradation, that the main anthropogenic threats to Prairie Pothole Region wetlands are drainage and land clearing, and that overgrazing and cultivation of riparian zones can directly impact the amount of vegetated

habitat available to sequester carbon, but also has a negative impact on the remaining wetland due to the nutrient loading associated with surface runoff or groundwater discharge.

Based on this, the following decision point for the workshop regarding baseline scenarios was proposed:

- The policy or implementation premise regarding ‘business as usual’ for wetlands in the Prairie Pothole Region is that, in the absence of a conservation or restoration project, the vast majority wetlands would be degraded or destroyed.

3.3.1.5 Additionality or Incrementality

The Implementation Discussion Document provided evidence that the GHG reductions and removals generated by the proposed Wetlands Protocol go beyond business as usual, and therefore are additional or incremental. It also justified the additionality of wetlands projects through discussion of several additionality tests, including surplus to regulation, investment barriers, technological barriers, institutional barriers, and not common practice. The Implementation Discussion Document did not assert that the GHG reductions and removals from the proposed Wetlands Protocol meet the test of financial additionality. Based on this, it was proposed that decision points for the workshop should include agreement with the justification of additionality as presented in the Implementation Discussion Document.

3.3.1.6 Ownership, Permanence & Leakage

Ownership

The Implementation Discussion Document identifies the need to define ownership of the offsets in the Wetlands protocol. Because of these, it proposes that the workshop decide whether: (1) the proposed Wetlands Protocol will be applicable only to private lands, and (2) the ownership criteria for the proposed Wetlands Protocol should be based on the experience and precedence which Ducks Unlimited and other similar conservation agencies have gained concerning legal agreements with funders and in conservation and restoration projects.

Permanence

With respect to permanence, the Implementation Discussion Document notes that reversals in Wetlands projects can result both from human decisions concerning management of the landscape (e.g. land managers could choose to drain a conserved or restored wetland) and from natural climatic variations (e.g. climate conditions could result in drying of the wetland). Because of this, the Document recommends that an assessment of risk of reversal associated with the proposed Wetlands Protocol, using a process like the Voluntary Carbon Standard guidance, should be completed using data from the conservation and restoration projects of agencies such as Ducks Unlimited Canada.

Furthermore, the Implementation Discussion Document recommends that the decision concerning strategy to ameliorate risk of reversal associated with the proposed Wetlands Protocol should be based on the results of the assessment of risk of reversal using data from the conservation and restoration projects of agencies such as Ducks Unlimited Canada. And, based on the strategy defined, the procedures, systems, and controls used by agencies such as Ducks Unlimited to monitor permanence of conservation and restoration projects should inform the criteria used in the Wetlands Protocol to monitor permanence.

Leakage

When applied to the proposed Protocol, the Implementation Discussion Document notes that leakage refers to the possibility that conserving or restoring wetlands in the Prairie Pothole Region would cause wetlands in other regions of similar character (semi-permanent wetlands on mineral soil enriched with sulphate) to be degraded or drained. Because this seems unlikely, the following decision points regarding leakage were recommended:

The Prairie Pothole Region should comprise the leakage belt for the Wetlands Protocol.

The Wetlands Protocol should require project proponents and/or aggregators to contribute to a database for monitoring of wetlands of the Prairie Pothole Region. This database would be used to assess intra-region leakage.

3.4 Science Discussion Document 2 - Quantification

Timeline — April 2009 to March 2010

The Implementation Discussion Document provided a comprehensive discussion of the fundamental framework and content of the proposed Wetlands Protocol, as described above. The Quantification Discussion Document was prepared as a companion piece to the Implementation Discussion Document, focusing on the details of quantifying GHG reductions and removals associated with conservation and restoration of wetlands in the Prairie Pothole Region of Canada.

The science is emerging regarding quantification of emissions of GHG from conserved and restored wetlands, and from the pristine and agricultural lands surrounding these wetlands. Therefore, the Quantification Discussion Document focused on discovering and supporting consensus among scientific researchers and technical practitioners concerning quantifiable and verifiable conservation and restoration practices and GHG quantification methodologies to meet the emission reductions criteria of ISO 14064-based North American GHG programs. The researchers and practitioners will gather at a Consultation Workshop where consensus will be sought based on questions posed in this Quantification Discussion Document.

PRINCIPLE 1: It is important to note the proposed Wetlands Protocol is designed to achieve ‘accuracy in aggregate’. That is, the quantification of GHG emissions using the proposed Protocol is not intended to achieve the site-specific predictive capability of a process model. General relationships between Protocol practices and emission reductions can be determined by expert judgment based on integration of empirical data, but these relationships, and the reductions derived from them, will not hold under all time- and site-specific circumstances. Thus, the development of a quantification approach for the Wetlands Protocol is similar to the derivation of coefficients for the Canada’s National Inventory Report; namely, general trends evident in empirical data can be applied to achieve generally accurate assessment of GHG emissions and reductions.

PRINCIPLE 2: At the Consultation Workshop, consensus will be sought for each Discussion Point, along with an opinion concerning the degree of uncertainty associated with the information upon which the decision is based. Discussion Points receiving a consensus opinion, defined as 80% agreement among designated scientific participants, will be the foundation for further development of the Wetlands Protocol. The ‘agreement’ score is the sum of the “Accept’ and ‘Accept with more work’ categories. Thus, the Workshop is designed to serve as ‘in-person peer

review', where the collective experience and expertise of the designated scientific participants is the authority for decisions. Usually, this will mean the scientific participants will be asked to interpret and apply evidence presented in the peer-reviewed literature. But, in some instances the designated scientific participants will be asked to use their judgment to fill gaps in the published scientific literature.

3.4.1 Scope

In the Quantification Discussion Document, discussion concerning the scope of the Wetlands Protocol pertained to (1) scope and identification of SSs, (2) quantification of reductions and removals, (3) delineation and monitoring of wetlands & uplands in baseline and project, and (4) next steps.

3.4.1.1 Scope and Identification of SSs

Based on the knowledge compiled and considered in Phase 1 of development of the Wetlands Protocol, the proposed Protocol will address the emissions of CO₂, CH₄, and N₂O from with the wetland, as well as from the riparian and upland zones associated with wetlands. The Quantification Discussion Document describes the importance of ensuring that the scope (boundaries) of the Wetlands Protocol consider the inter-relatedness of upland management and wetland GHG emissions; prescribe eligible sequestration mechanisms; the potential is introduced for a wider range of project conditions, and therefore a greater number of possible SSs, should establishing permanent cover be associated with conservation or restoration of wetlands; and defining the physical activities required to conserve or restore wetlands need to be defined as well as determining the energy requirements of these.

Based on these considerations, lists and associated figures SSs to be included in the scope of the baseline and project scenarios were proposed (included herein as Appendix A). The Quantification Discussion Document further proposed decision points for the workshop as to whether the lists and figures were complete and accurate.

Of the identified SSs, the Quantification Discussion Document developed a proposed list of relevant SSs and associated decision point for the workshop as to whether the list was complete and accurate. The list is included herein as Appendix B.

3.4.1.2 Quantification of Reductions and Removals

Status of Prairie Pothole Region Wetlands as Net GHG Sinks

The Quantification Discussion Document notes the strong relationship between the two types of project activities or practices (conservation of existing wetlands and restoration of drained wetlands) in expected in the Wetlands Protocol, and the additionality and incrementality of the project (as discussed in the Implementation Discussion Document). Because of this, the Quantification Discussion Document focussed on describing the GHG emissions from a drained wetland, reviewing the National Sinks Table Foundation Paper (Environment Canada 1998), the Wetlands and Carbon Sequestration Workshop at the Oak Hammock in Manitoba, Philips et al. (2003 & 2007), Euliss et al. (2006), and Bedard-Haughn et al. (2006).

Based on the review, the Quantification Discussion Document proposed that since a range of gross sequestration values for restored wetlands was found to exist, this established a context within which the sequestration coefficient of the proposed Wetlands Protocol should be derived.

Forthcoming Scientific Knowledge

The Quantification Discussion Document outlined the preliminary results of the Agriculture and Wetlands Greenhouse Gas Initiative (AWGI), as the final and synthesized results were not yet available. Based on the results, the following decision points were proposed:

- The credibility of the participants in the AWGI, the design and extent of the research, and the preliminary results of the project provide sufficient basis to recommend the net sequestration coefficient of 7.3 – 11.8 Mg CO₂eq ha⁻¹ year⁻¹ for consideration at the Consultation Workshop. (NOTE: The Implementation Discussion Document recommends that uplands are managed according to a GHG reduction protocol, so N₂O emission associated with movement of nitrate into the wetland would be minimized if this recommendation were implemented.)
- There is sufficient evidence to recommend as a consideration for the Consultation Workshop that methane emission is negligible from Prairie Pothole Region wetlands with SO₄ concentration ≥ 200 mg L⁻¹.

3.4.2 Delineation and Monitoring of Wetlands & Uplands in Baseline and Project

In anticipation of the Consultation Workshop, the Quantification Discussion Document introduced the experience gained, the tools developed, and the processes, systems, and controls implemented by Ducks Unlimited Canada in their wetland conservation and restoration efforts would provide a frame of reference for the development of the Wetlands Protocol.

3.5 Consultation Workshop

The Consultation Workshop for the Wetlands Protocol was held 17 to 18 March 2010 at the Airport Delta Hotel in Edmonton. Details of the Consultation Workshop are posted on the website: <http://carbonoffsetsolutions.climatechangecentral.com/offset-protocols/alberta-protocol-development-workshops>

3.5.1 Names, Affiliations, and Roles of Participants in the Consultation Workshop

The participants of the Consultation Workshop comprised representatives of government and university research organizations, industry associations, not for profits, and government agencies. In addition to the Overview Committee, about 70 individuals received invitations to the Workshop. Of those invited, 43 individuals responded and thus received the Implementation and Quantification Discussion Documents for review and comments. The participants attending the Consultation Workshop numbered XX attended.

Table 1. Names and Affiliations of Participants in the Consultation Workshop.

Name	Affiliation
Steering Committee	
Cynthia Edwards	Ducks Unlimited Canada
Tanya Maynes	Climate Change Central
Pascal Badiou	Ducks Unlimited Canada
Rick Bourbonniere	Environment Canada
Tom Goddard	Alberta Agriculture and Rural Development
Bob MacFarlane	Prairie Habitat Joint Venture
Leslie Wetter	Ducks Unlimited Canada
Rob Janzen	ClimateCHECK

Contractors and Workshop Facilitator	
Amanda Stuparyk	Climate Change Central
Fiona Law	CompuTouch
Canadian Researchers	
Angela Bedard-Haughn	University of Saskatchewan
Irena Creed	University of Western Ontario
Lee Foote	University of Alberta
Roger Bryan	Institute of Agriculture, Forestry and the Environment
Suzanne Bayley	University of Alberta
Industry And Association Representatives	
Barry Bishop	Ducks Unlimited - Canada
Brian Ilnicki	Land Stewardship Centre of Canada
Chad Croft	Alberta Conservation Association
Cynthia Edwards	Ducks Unlimited - Canada
David Browne	Canadian Wildlife Federation
Don McCabe	Soil Conservation Council of Canada
Jay Anderson	EarthEcon
Lisette Ross	Ducks Unlimited - Canada
Lyle Boychuk	Ducks Unlimited - Canada
Per Andersen	Nature Conservancy of Canada
Sharon McKinnon	Crop Working Group
Government	
Jason Cathcart	Alberta Agriculture and Rural Development
Mike Watmough	Canadian Forest Service
Marian Weber	Alberta Research Council
Rob Hamaliuk	Alberta Environment
Robyn Kuhn	Alberta Environment
Sheilah Nolan	Alberta Agriculture and Rural Development
Sid Carlson	Alberta Research Council
Tony Brierley	Agriculture and Agri-food Canada

¹ All invited participants received a copy of the Science Discussion Document, and were given the opportunity to provide written comments.

² Only participants with a graduate degree in an appropriate science discipline were given the privilege to vote on options to develop the Wetlands Protocol.

3.5.2 Decisions of the Consultation Workshop

The decisions of the Consultation Workshop were based on the preparation provided in the Implementation and Quantification Discussion Documents, the presentations at the Workshop, the discussions within the working groups, and the consensus of the convened participants. The agenda of the Workshop, the presentations to the Workshop participants from the science experts, and the Record of Discussion are available at the website:

<http://carbonoffsetsolutions.climatechangecentral.com/offset-protocols/alberta-protocol-development-workshops>

3.5.2.1 Agenda

The two-day Workshop, entitled Wetlands Conservation and Restoration Protocol Development, proceeded as follows:

WEDNESDAY MARCH 17, 2010 8:30 – 4:00 pm

The focus for Day One was to provide an opportunity to learn about the current policy, quantification and inventory methodologies, various protocol approaches and will suggest proposed options for the best available quantification approaches.

8:30 **Welcome and Introductions** (Introductory Slides); Tanya Maynes, Climate Change Central

8:45 **Setting the Scene – (i) Carbon Offsets and the Policy Drivers**; Tanya Maynes, Climate Change Central

SETTING THE SCENE – (ii) Overview of Wetlands Conservation and Restoration Protocol; Rob Janzen, Climate-CHECK

10:00 (10:30AM) **Greenhouse Gas Sources and Sinks in Canada: Science Based Knowledge Needs**; Rick Bourbonniere, Environment Canada (Dominique Blaine, Environment Canada on the phone)

10:45 **GIS Wetlands Inventory on the Prairies – Determining the Baseline**; Lyle Boychuk – Ducks Unlimited Canada

12:45 **Summary of GHG Emissions and Carbon Sequestration Potential in Wetlands of the Canadian Prairie Pothole Region**; Pascal Badiou – DU Canada

1:30 **Procedures & Controls to Delineate, Conserve, Restore and Monitor Wetlands**; Lyle Boychuck – Ducks Unlimited Canada

2:30 (2:45PM) **Determining the Framework**; Facilitated Discussion – Plenary & Polling for Day 1 – Foundational Issues Discussion Guide

4:00 **Summary and Close of Day One**

THURSDAY MARCH 18, 2010 8:30am – 4:00 pm

The focus for Day 2 was to engage participants in developing, evaluating and recommending criteria for the practical side of the protocol including implementation and quantification.

8:30 **Welcome – Recap from Day one and Review agenda for Day Two**; Tanya Maynes, Climate Change Central

9:00 **Discussion of Criteria to Quantification Methodology**; Facilitated Discussion – Plenary

1:00PM (11:15 AM) **Implementation Discussion**; Facilitated Discussion – Plenary

12:45PM **Implementation Discussion - Continued**; Facilitated Discussion – Plenary

2:45 **Compilation and Prioritization of Research Gaps/Evaluation of Workshop;** Tanya Maynes, Climate Change Central & Rob Janzen, ClimateCHECK

3:00 **Use of Workshop Results and Next Steps;** Tanya Maynes, Climate Change Central

3.5.2.2 *Decisions by Polling*

On both days of the workshop, workshop participants were given the opportunity to vote on the decision points identified in the Implementation and Quantification Discussion Documents. In total, xx participants voted. The text in the boxes represents the final voting question, as some decision points were modified from the Discussion Documents during the workshop.

Day 1 Decisions:

In the proposed Wetlands Protocol, the **wetland basin** will be defined as the area extending from the centre of the wetland to the outer edge of the wet meadow zone. It is understood that the size and location of the wetland basin fluctuates within and among years depending on hydrologic condition (wet/dry periods), according to Gleason et al. (2008) (Figure 1) up to and including the overflow/spill elevation.

VOTING – 94% Acceptable; 6% Acceptable with more work

In the proposed Wetlands Protocol, the wetland margin will be defined as the area extending from the outer edge of the wetland basin to the outer edge of the toe slope.

VOTING – 82% Acceptable; 18% Acceptable with more work

In the proposed Wetlands Protocol, the **wetland** will be defined to include the area of the wetland basin and wetland margin.

VOTING – 94% Acceptable; 6% This option is a no-go

In the proposed Wetlands Protocol, the **upland** will be defined as the area contributing surface runoff to the wetland zone and is composed of the landscape that is upgradient of the toe slope, but does not include the foot slope.

VOTING – 79% Acceptable; 21% Acceptable with more work

The proposed Wetland Protocol will define wetland loss as including infilling, altering, or physically draining the wetland, any transitory or permanent degradation of the wetland basin and/or margin, and any type of interference with the hydrology to and from the wetland.

VOTING – 81% Acceptable; 19% Acceptable with more work

The premise of the Wetlands Conservation and Restoration Protocol is consistent in logic with recent policy developments in compliance and voluntary GHG programs across the world.

VOTING – 67% Acceptable; 33% Acceptable with more work

Initially, the proposed Wetlands Protocol will be applicable only to private lands.

VOTING – 56% Acceptable; 33% Acceptable with more work; 11% This option is a no-go

Day 2 Decisions:

Scientific evidence exists to develop a protocol to quantify net GHG emissions reductions and removals associated with functional prairie wetlands to create real and verifiable offsets.

VOTING – 75% Acceptable; 25% Acceptable with more work

Existing practice concerning wetland conservation and restoration in the Prairie Pothole Region allows the development of a GHG quantification protocol to create real and verifiable offsets.

VOTING – 71% Acceptable; 29% Acceptable with more work

A large proportion of wetlands and associated uplands in the Prairie Pothole Region of Canada have been degraded as a result of landscape alteration and therefore it is reasonable to assume the vast majority wetlands in this region have been subjected to or are vulnerable to wetland loss.

VOTING – 82% Acceptable; 18% Acceptable with more work

For restoration, the most suitable approach for determination of the baseline for the proposed Wetlands Protocol would be – Historical – 85%, Performance Standard 5%, Projection based 10%

For conservation, the most suitable approach for determination of the baseline for the proposed Wetlands C&R Protocol would be – Historical – 6%, Performance Standard 11%, Projection based 83%

For the Wetlands C&R Protocol definition and delineation of Prairie Pothole Region Wetlands should be classified according to Stewart and Kantrud (1971) per Class III through Class V wetlands.

VOTING – 94% Acceptable; 6% Acceptable with more work

The Ss identified and described for the baseline scenario (Figure 1, Table 1) of the proposed Wetlands C&R Protocol are complete and accurate.

VOTING – 71% Acceptable; 29% Acceptable with more work

The Ss identified and described for the project condition (Figure 2, Table 2) of the proposed Wetlands C&R Protocol are complete and accurate.

VOTING – 75% Acceptable; 19% Acceptable with more work; 6% This option is a no-go

The decisions stated and justification provided to include or exclude Ss of the baseline scenario and project conditions are complete and accurate (table 3 of the Quantification SDD).

VOTING – 88% Acceptable; 12% Acceptable with more work

The research results reported by Euliss et al. (2006) and Bedard-Haughn et al. (2006) provide a range of gross sequestration values for restored wetlands, and thereby establish a context within which the sequestration coefficient of the proposed Wetlands C&R Protocol should be derived.

VOTING – 88% Acceptable; 12% Acceptable with more work

The credibility of the participants in the AWGI, the design and extent of the research, and the peer-reviewed results of the project provide sufficient basis to recommend the net sequestration coefficient of 1.4 - 2.0 Mg C ha⁻¹ year⁻¹ (during the net accumulation period) for consideration at the Consultation Workshop.

VOTING – 47% Acceptable; 47% Acceptable with more work; 6% This option is a no-go

The net sequestration coefficient will be defined in the lower quartile of the scientifically-defensible range.

VOTING – 72% Acceptable; 28% Acceptable with more work

Initially, a scientifically-defensible range will be defined by publication of the results of the AWGI project and other existing relevant literature.

VOTING – 95% Acceptable; 5% Acceptable with more work

The procedures, systems, and controls used by Ducks Unlimited (outlined in the "Project Guidance" document circulated) in wetland conservation and restoration projects in the Prairie Pothole Region of Canada should be used as the frame of reference to develop the wetland delineation approach for the proposed Wetlands C&R Protocol.

VOTING – 88% Acceptable; 12% Acceptable with more work

A qualified and experienced specialist should be required to approve the delineation (and classification) of wetlands included in all projects under the proposed Wetlands C&R Protocol.

VOTING – 80% Acceptable; 20% Acceptable with more work

To demonstrate that wetland conservation and restoration is not ‘business-as-usual’, the proposed Wetlands Protocol fulfills the following tests:

VOTING

- a. Surplus to regulation: 100% Agree; 0% Disagree
- b. Investment barriers: 100% Agree; 0% Disagree
- c. Technological barriers: 100% Agree; 0% Disagree
- d. Institutional barriers: 93% Agree; 7% Disagree
- e. Not common practice: 100% Agree; 0% Disagree

The proposed Wetlands C&R Protocol should be designed to allow project proponents to use complementary protocols to generate GHG reductions and removals in the wetland margin and associated upland.

VOTING – 89% Acceptable; 11% Acceptable with more work

The procedures, systems, and controls used by agencies such as Ducks Unlimited to monitor permanence of conservation and restoration projects will inform the criteria used in the Wetlands C&R Protocol to monitor permanence.

VOTING – 47% Acceptable; 47% Acceptable with more work; 7% This option is a no-go

Conservation activity involves:

- a. Termination of burning, clearing, and cultivating of the wetland margin

VOTING – 71% Acceptable; 21% Acceptable with more work; 7% This option is a no-go

- b. Improvement of management of the wetland margin

VOTING – 40% Acceptable; 53% Acceptable with more work; 7% This option is a no-go

- c. Improvement of management of the associated upland

VOTING – 60% Acceptable; 33% Acceptable with more work; 7% This option is a no-go

In the proposed Wetlands C&R Protocol, restoration will include activity to reverse wetland loss as a result of permanent impacts (Turner et al. 1987). Thus, restoration activity involves:

- a) All activity prescribed for conservation

VOTING – 73% Acceptable; 20% Acceptable with more work; 7% This option is a no-go

- b) Reversal of drainage and filling

VOTING – 100% Acceptable

The assessment of risk of reversal associated with the proposed Wetlands C&R Protocol, using a process like the Voluntary Carbon Standard guidance, should be completed using data from the conservation and restoration projects of agencies such as Ducks Unlimited Canada.

VOTING – 47% Acceptable; 47% Acceptable with more work; 7% This option is a no-go

The Prairie Pothole Region should comprise the leakage belt for the Wetlands Protocol.

VOTING – 47% Acceptable; 47% Acceptable with more work; 7% This option is a no-go

*Note: the above question and vote results were reported in draft workshop minutes but not in dedicated poll results report.

There is a high probability of leakage in the Prairie Pothole Region.

VOTING – 42% Agree; 58% Disagree

4 Protocol Development Process — Preparation of Technical Seed Document

The consensus discovered through consultation with experts and stakeholders will be incorporated into a Technical Seed Document which comprises the framework of the proposed Wetlands Protocol. The final development of the protocol will involve the technical requirements framed in the Technical Seed Document and reformatting them into the prescriptive criteria needed in an ISO 14064-based reduction quantification protocol and Alberta Environment requirements which can be verified at a high level of assurance.

The Technical Seed Document will build upon expert consultation to date to finalize outstanding elements of implementation and quantification of the Wetland Protocol. This Consultation Workshop Report provides the foundation of this effort by summarizing development decisions to date, and by describing the gaps to be addressed in the preparation of the Technical Seed Document.

Two types of gaps needed to be addressed in the preparation of the Technical Seed Document were raised at the Consultation Workshop. First, some polling points received agreement as the total of the two categories 'Accept' and 'Accept with more work', but outcomes with a high proportion of the 'Accept with more work' category must be addressed before the Technical Seed Document can be completed. Second, some gaps to be filled before completion of the Technical Seed Document were identified during discussion between polling points.

4.1 Issues arising from Polling at the Consultation Workshop

Although the comprehensive and innovative interaction among participants during the Consultation Workshop provided consensus for many discussion points, a few issues were identified through the pooling process as needing further effort. These issues are described in this Workshop Report to identify effort needed to prepare the Technical Seed Document.

Issue 1: The workshop participants provided clear consensus concerning the approach for baseline determination of the proposed Wetlands protocol. The Historical approach was determined for the restoration aspect of the protocol, and the Projection-based approach was determined for the conservation aspect. These approaches will need to be designed in the Technical Seed Document, so that the final protocol can prescribe the details needed to implement the proposed Wetlands protocol in a verifiable manner.

Issue 2: The issue of whether the protocol should apply to private lands only received relatively low agreement in polling results. It was pointed out that clear grazing leases are excluded (the view of Alberta Sustainable Resource Development is not fully clear), though such leases do not assume any ownership on offsets. Additionally, it was suggested that the protocol should allow opportunity for aboriginal lands to be managed. When the wording of the question was softened to state that the restriction to private lands would be an initial one, the majority of workshop participants agreed with this approach (Accept 56%, and Accept with more work 33%). The relatively large proportion of participants requesting more work merits attention to this element in the further development of the protocol.

Issue 3: The sequestration coefficient of $1.4 - 2.0 \text{ Mg CO}_2\text{eq ha}^{-1} \text{ year}^{-1}$ derived from the results of the Agriculture and Wetlands Greenhouse Gas Initiative (AWGI) was presented to the workshop participants as the basis for quantifying net GHG reductions from restoration of wetlands in the Prairie Pothole Region. A subsequent question to use in the lower quartile of the scientifically-defensible range achieved general consensus, but scientifically-defensible was defined very broadly as the "results of the AWGI project and other existing relevant literature". However, the final polling question specified that the publication of the AWGI results in the peer-reviewed would constitute the appropriate justification for use of the lower range of the AWGI value to quantify net GHG reductions from restoration and conservation of wetlands in the Prairie Pothole Region (95% Accept). It will therefore be necessary to achieve publication of the AWGI results to justify the quantification approach used in the proposed Wetlands protocol.

Issue 4: Adapting the procedures, systems, and controls used by agencies such as Ducks Unlimited to monitor permanence of conservation and restoration projects to inform the criteria used in the Wetlands Protocol to monitor permanence was not an idea that received clear consensus from the working group (Accept 47%, and Accept with more work 47%). Other suggestions included monitoring procedures, e.g. for site visits repeated on a cycle, sampling in field, etc. Achieving clear consensus concerning this element of the proposed Wetlands Protocol will require more effort, including the completion of the non-proprietary procedures manual being prepared by Ducks Unlimited Canada.

Issue 5: Although participants provided consensus concerning the activity constituting restoration of wetlands, some ambiguity remains concerning practices of conservation and of management of restored or conserved wetlands. Further effort will be needed to define the activity of margin and upland management which can be prescribed in the protocol as verifiable practices for conservation of wetlands, particularly with respect to the practices involving grazing of wetland margins. This effort to define wetland management activity is closely connected to the completion of the procedures manual by Ducks Unlimited Canada.

Issue 6: The workshop participants did not arrive at a clear consensus on how to assess the risk of reversal in the Wetlands Protocol. This will require further effort to achieve the level of consensus needed to prepare a Technical Seed Document.

Issue 7: The boundaries within which leakage should be considered were not defined by the workshop participants. Proposal, apart from the use of the Prairie Region as the leakage belt, included applying a discount factor (similar to the CAR approach), or using a whole farm approach (conserving all wetlands in an area). This will require further effort to achieve the level of consensus needed to prepare a Technical Seed Document.

4.2 Issues arising from Discussion at the Consultation Workshop

The preparation of the Technical Seed Document will need to address:

- The level of temporal variability associated with function of wetlands in the Prairie Pothole Region.
- The potential for sequestration of carbon in wetland mineral soils to reach a maximum;
- A new representation of a Prairie Pothole Region wetland to replace the figure from Gleason *et al.* (2008), defining toe slope and foot slope in the manner determined by the participants of the Consultation Workshop;
- The potential for vegetation to act as a conduit of methane emission from the wetland (this mechanism of release would not have been captured in the methods used in the AUGI research); and
- Determination of factors influencing potential reversals of conservation or restoration activity, including assessment of instruments to support permanence of the projects supported by the proposed Wetlands Protocol.

5 Outline of Remaining Process for Approval in Alberta Offset System

The next steps in the protocol development process include:

- Prepare Technical Seed Document (TSD), including
 - Prepare draft
 - Circulate for comment
 - Compile comments
 - Finalize
- Formulate the Technical Protocol Plan (TPP)
- Submit TSD and TPP to Alberta Environment (AENV)
- Standardize Protocol into AB format according to Guidance
- 1st Round Review, including
 - Organize and hold Technical Working Group (TWG) Meeting
 - TWG Follow-up based on comments
 - Finalization of Protocol for 2nd Round
- 2nd Round Review, including
 - Presentation at 2nd Round Review
 - Incorporate comments from Review
 - Finalize for public posting
- 3rd Round (Public) Review, including
 - Document posted for minimum 30 days
 - Finalize Protocol based on comments
 - Finalize Protocol for submission to AENV
 - Compile necessary documents and submit to AENV for approval

6 References

The publications listed below represent the breadth and depth of scientific knowledge referenced to develop the technical foundation of the Wetlands Conservation and Restoration Protocol. These publications provide the evidence deliberated in the Technical Background Document, support the considerations integrated in the Science Discussion Document, and contribute to the decisions recorded in the Consultation Workshop Report.

- Adams, J. 2007. Effects of potential changes in nitrogen loads to nitrous oxide efflux from prairie potholes. Honours Thesis. Department of Biology.
- Alberta Environment. 2007a. Guide to the Code of Practice for Pipelines and Telecommunication Lines Crossing a Body of Water. <http://www3.gov.ab.ca/env/water/legislation/cop/pipeline.pdf>.
- Alberta Environment. 2007b. Provincial wetland restoration / compensation guide. ISBN 978-0-7785-5479-0 (On-line). http://environment.alberta.ca/documents/Provincial_Wetland_Restoration_Compensation_Guide_Feb_2007.pdf.
- Alberta Water Council. 2008. DRAFT. Recommendations for a new Alberta wetland policy. www.AWChome.ca.
- Austen, E. and A. Hanson. 2008. Identifying wetland compensation principles and mechanisms for Atlantic Canada using a Delphi approach. *Wetlands*. 28: 640–655.
- Badiou, P., D. Pennock, and R. McDougal. 2008. Personal Communication. PowerPoint presentation to summarize results of Agriculture and Wetlands Greenhouse Gas Initiative research results Carbon sequestration and greenhouse gas emissions in Canadian prairie wetlands.
- Bartzen, B. 2008. Wetland characteristics and abundance of breeding ducks in prairie Canada . M.Sc. Thesis. University of Saskatchewan, Saskatoon.
- Bedard-Haughn, A., F. Joengbloed, J. Akkerman, A. Uijl, E. de Jong, T. Yates, and D. Pennock. 2006. The effects of erosional and management history on soil organic carbon stores in ephemeral wetlands of hummocky agricultural landscapes. *Geoderma*. 135: 296-306.
- Boychuk, L. Personal Communication. Manager of GIS and Inventory Programs. Ducks Unlimited Canada.
- CCAR. 2009. Greenhouse Gas Mitigation Typology Issues Paper Tidal Wetlands Restoration. Prepared for California Climate Action Registry by Philip Williams & Associates Ltd with Science Applications International Corporation (SAIC). <http://www.climateregistry.org/resources/docs/protocols/issue-papers/Tidal-Wetlands.pdf>.
- Corps of Engineers— Environmental Laboratory. 1987. Wetlands delineation manual. Technical Report Y-87-1. <http://el.erdc.usace.army.mil/wetlands/pdfs/wlman87.pdf>.
- Cox, K.W., and A. Grose. 2000. Wetland mitigation in Canada: A framework for application. Issues Paper, No. 2000-1. North American Wetlands Conservation Council. ISBN: 0-662-28513-1.
- Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/wetlands/wetloss/index.htm> (Version 16JUL97).

- Dahl, T.E. 2006. Status and trends of wetlands in the conterminous United States 1998 to 2004. Fish and Wildlife Service, US Department of the Interior, Washington, D.C. 112 pp.
http://www.fws.gov/wetlands/_documents/gSandT/NationalReports/StatusTrendsWetlandsConterminousUS1998to2004.pdf.
- Dahl, T.E. and M.D. Watmough. 2007. Current approaches to wetland status and trends monitoring in prairie Canada and the continental United States of America. *Can. J. Remote Sensing*. 33, Suppl. 1: S17-S27.
- Driver, E.A. and D.G. Peden. 1977. The chemistry of surface water in prairie ponds. *Hydrobiologia*. 53: 33-48.
- Ducks Unlimited Canada. 2008. The impacts of wetland loss in Manitoba. A brochure to describe the results of research in the Broughton's Creek watershed, published with participation of Agriculture and Agri-Food Canada, Environment Canada, and Natural Resources Canada.
- Ducks Unlimited. 2009. Ducks Unlimited Avoided Grassland Conversion Project in the Prairie Pothole Region. Climate, Community, and Biodiversity Alliance Report. Prepared by Ducks Unlimited, Inc., New Forests, Inc. Equator, LLC. http://www.climate-standards.org/projects/files/20090323_du_agc_ccba_final_for_release.pdf.
- Environment Canada. 1998. National sinks Table foundation Paper. Pollution Data Branch, Hull.
http://www.ec.gc.ca/pdb/ghg/Related_Docs/sinks_found_e.cfm.
- Environment Canada. 2008. National Inventory Report. Greenhouse Gas Sources and Sinks in Canada. 1990 – 2006. http://www.ec.gc.ca/pdb/GHG/inventory_report/2006_report/tdm-toc_eng.cfm.
- Euliss, N.H. Jr., R.A. Gleason, A. Olness, R.L. McDougal, H.R. Murkin, R.D. Robarts, R.A. Bourbonniere, and B.G. Warner. 2006. North American prairie wetlands are important non-forested land-based carbon storage sites. *Sci. Total Environ.* 361:179-188.
- Euliss Jr., N.H., L.M. Smith, D.A. Wilcox, and B.A. Browne. 2008. Linking ecosystem processes with wetland management goals: Charting a course for a sustainable future. *Wetlands* 28: 553-562.
- Gleason, R.A., Euliss, N.H., McDougal, R.L., Kermes, K.E., and E.N. Steadman. 2005. Potential of restored prairie wetlands in the glaciated North American prairie to sequester atmospheric carbon. *Plains CO₂ Reduction (PCOR) Partnership*.
- Gleason, R.A., M.K. Laubhan, and N.H. Euliss Jr., Eds. 2008. Ecosystem services derived from wetland conservation practices in the United States Prairie Pothole Region with an emphasis on the U.S. Department of Agriculture Conservation Reserve and Wetlands Reserve Programs: U.S. Geological Professional Paper 1745, 58 p.
- Heagle, D.J. M. Hayashi, G. van der Kamp. 2007. Use of solute mass balance to quantify geochemical processes in a prairie recharge wetland. *Wetlands*. 27: 806-818.
- Helgason, B.L. 2005. GHGFarm Version 1.0. An assessment tool for estimating net greenhouse gas emissions from Canadian farms. Agriculture and Agri-Food Canada, Lethbridge.
- Houlahan, J.E. and C.S. Findlay. 2004. Estimating the 'critical' distance at which adjacent land-use degrades wetland water and sediment quality. *Landscape Ecology*. 19:677-690.

- Jin, X., S. Wang, and Y. Zhou. 2008. Dynamic of organic matter in the heavy fraction after abandonment of cultivated wetlands. *Biol. Fertil. Soils*. 44: 997-1001.
- Merbach, W., T. Kalettka, C. Rudat, and J. Augustin. 2002. Trace gas emissions from riparian areas of small eutrophic inland waters in northeast Germany. *In* Broll, G., W. Merbach, and E.V. Pfeiffer, Eds. *Wetlands in Central Europe: Soil organisms, soil ecological processes, and trace gas emissions*. Berlin, Springer. pp. 235–244.
- Mitsch, W.J. and J.G. Gosselink. 2007. *Wetlands*, 4th ed., John Wiley & Sons, Inc., New York, 582 pp.
- Myers, E.C. 2006. Climate Change and Forestry: A REDD Primer, The Ecosystem Marketplace, http://www.ecosystemmarketplace.com/pages/article.news.php?component_id=5797&component_version_id=8792&language_id=12.
- Offset Quality Initiative. 2008. Ensuring Offset Quality, Integrating High Quality Greenhouse Gas Offsets into North American Cap-and-Trade Policy. http://www.offsetqualityinitiative.org/pdfs/OQI_Ensuring_Offset_Quality_Exec_Sum_7_08.pdf.
- Pena, N. 2009. Including peatlands in post-2012 climate agreements: Options and rationales. Report by Joanneum Research commissioned by Wetlands International. <http://www.wetlands.org/LinkClick.aspx?fileticket=vDxo4SgYVXM%3d&tabid=56>.
- Philips, R.L., Beerli, O., and E.S. DeKaiser. 2003. Soil trace gas flux for wetland vegetation zones in North Dakota prairie pothole basins. American Geophysical Union, Fall Meeting 2003, Abstract #B22A-0791.
- Philips, R.L. and O. Beerli. 2007. The role of hydrogeologic vegetation zones in greenhouse gas emissions for agricultural wetland landscapes. *Catena*. 72: 386-394.
- Pierce, J. Personal Communication. Wildlife Biologist — Natural Advantage. Ducks Unlimited Canada.
- Pritchard, D. 2009. Reducing emissions from deforestation and forest degradation in developing countries (REDD) - the link with wetlands. http://www.field.org.uk/files/WetlandsREDD_FINAL_26.3.pdf.
- Ramsar Secretariat (2008): Additional information on climate change and wetlands issues. COP10 Information Paper DOC 25. http://www.ramsar.org/cop10/cop10_doc25_e.pdf.
- Scholz, I. and L. Schmidt. 2008. Reducing Emissions from Deforestation and Forest Degradation in Developing Countries: Meeting the main challenges ahead. Briefing Paper 6/2008. German Development Institute.
- Society of Wetland Scientists. 2000. Position paper on the definition of wetland restoration. <http://www.sws.org/documents/positionpapers/restoration.pdf>.
- Stewart, R. E., and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, D.C. www.npwrc.usgs.gov/resource/wetlands/pondlake/index.htm.
- Terrestrial Carbon Group. 2008. How to include terrestrial carbon in developing nations in the overall climate change solution. terrestrialcarbon.org. ISBN 978-0-646-49550-7.

- The Royal Society (2008): Biodiversity-climate interactions: adaptation, mitigation and human livelihoods. Report of an international meeting, London June 2007. The Royal Society, London. <http://royalsociety.org/displaypagedoc.asp?id=29026>.
- Turner, B.C., G.S. Hochbaum, F.D. Caswell, and D.J. Nieman. 1987. Agricultural impacts on wetland habitats on the Canadian Prairies, 1981 – 1985. Transactions of the North American Wildlife and Natural Resources Conference. 52:207-215.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., USA and Environment Canada, Canadian Wildlife Service, Ottawa, Ontario, Canada.
- van der Kamp, G. and M. Hayashi. 2009. Groundwater-wetland ecosystem interaction in the semiarid glaciated plains of North America. Hydrogeology Journal. 17: 203-214.
- Voldseth, R. A., W. C. Johnson, T. Gilmanov, G. R. Guntenspergen, and B. V. Millett. 2007. Model estimation of land-use effects on water levels of northern prairie wetlands. Ecological Applications 17:527-540.
- Watmough, M. D., and M. J. Schmoll. 2007. Environment Canada's Prairie & Northern Habitat Monitoring Program Phase II: Recent habitat trends in the PHJV. Technical Report Series No. 493. Environment Canada, Canadian Wildlife Service, Edmonton, Alberta, Canada.
- Wetlands International. 2008. Sustaining and restoring wetlands: An effective climate change response. http://www.wetlands.org/Portals/0/publications/Brochure/wetlands_adaptation_press19aug.pdf.
- Zimpfer, N.L., G.S. Zimmerman, E.D. Silverman, and M.D. Kone. 2008. Trends in Duck Breeding Populations, 1955-2008 - Administrative Report. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, Maryland.

Appendix A – Proposed Project and Baseline SSs

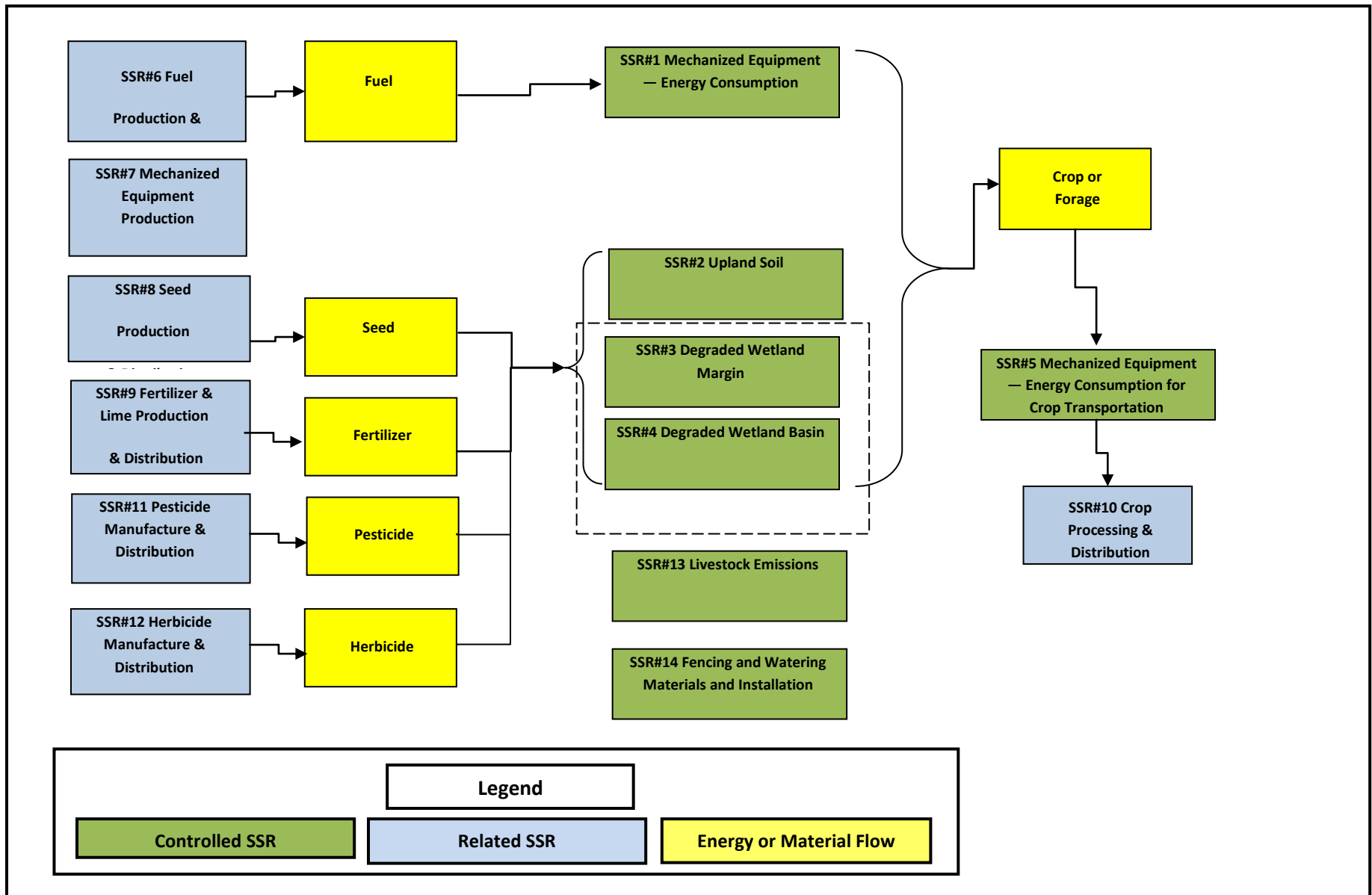


Figure 1. Diagram of SSs associated with the baseline scenario for the proposed Wetlands Protocol, a drained or degraded wetland.

Table 1. Controlled, related, and affected SSs for the baseline scenario of the proposed Wetlands Protocol, a drained or degraded wetland.

IDENTIFIER	NAME	DESCRIPTION	CONTROLLED, RELATED OR AFFECTED
SS1	Mechanized Equipment – Energy Consumption for Farming Operations	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated when mechanized equipment is used for cultivation, seeding, applying fertilizer, herbicide or pesticide, harvesting (swathing, combining, baling), and transporting crop products onsite. This SSR also includes emissions associated with equipment and energy needed, if any, to alter the natural landscape to drain wetlands (i.e. create drainage passages).	Controlled
SS2	Upland Soil	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O, and including net SOC sequestration if occurring) associated with upland soils. This soil may be cropped or in perennial forage.	Controlled
SS3	Degraded Wetland Margin	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O) associated with degraded margin soils.	Controlled
SS4	Degraded Wetland Basin	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O) associated with wetlands degraded and cropped.	Controlled
SS5	Mechanized Equipment – Energy Consumption for Crop Transportation	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the offsite transportation of crop or crop products, including forages, to the point of sale or final use.	Controlled
SS6	Fuel Production and Transportation	GHG Emissions of CO ₂ , CH ₄ and N ₂ O are generated from the upstream exploration, production processes and distribution of diesel and other fuels.	Related
SS7	Materials and Equipment Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated from the input of materials and energy in the manufacturing and distribution of materials and equipment.	Related

SS8	Seed Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated in the process of collecting, cleaning, storing and distributing seed for crops.	Related
SS9	Fertilizer and Lime Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacturing and distribution of fertilizer and lime.	Related
SS10	Mechanized Equipment – Energy Consumption for Crop Processing and Distribution	GHG emissions associated with the cleaning, handling and final distribution of crop products, including forages.	Related
SSR11	Pesticide Manufacture and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacture and off site transportation of pesticide.	Related
SS12	Herbicide Manufacture and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacture and off site transportation of herbicide.	Related
SS13	Livestock Emissions	GHG emissions of N ₂ O and CH ₄ and are associated with the manure of grazing animals. Enteric emissions of CH ₄ are produced as a by-product of digestion that are exhaled or eructated from the grazing livestock.	Controlled
SS14	Fencing and Watering Materials and Installation	GHG Emissions of CO ₂ , CH ₄ and N ₂ O are associated with the energy and materials required to fence the land and install watering facilities.	Controlled

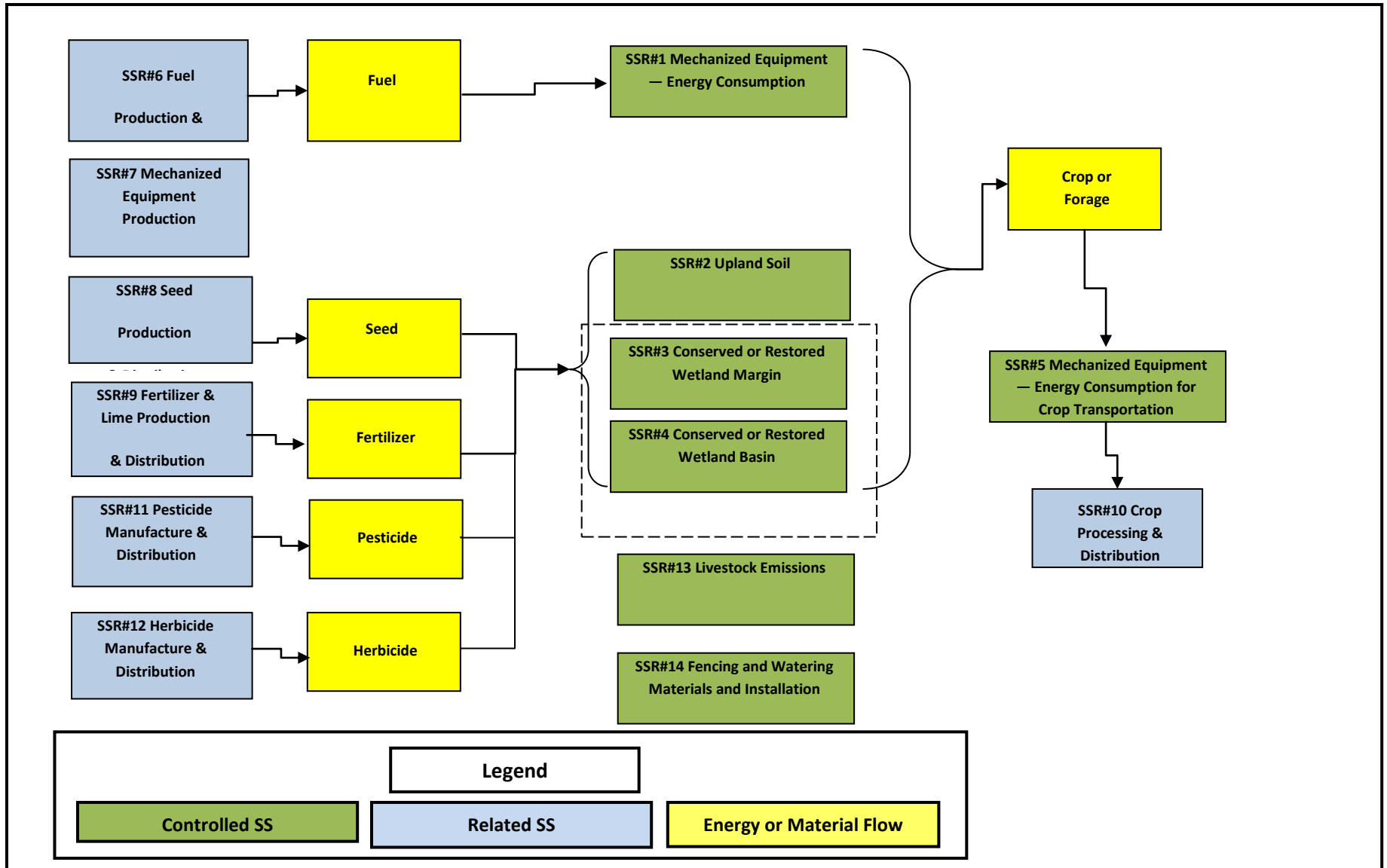


Figure 2. Diagram of SSRs associated with the project condition for the proposed Wetlands Protocol, a functional wetland.

Table 2. Controlled, related, and affected SSRs for the project condition of the proposed Wetlands Protocol, a functioning wetland.

SSR IDENTIFIER	SSR NAME	DESCRIPTION	CONTROLLED, RELATED OR AFFECTED
SS1	Mechanized Equipment – Energy Consumption for Farming Operations	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated when mechanized equipment is used for hay harvest (swathing and baling) and onsite transportation of hay. This SSR includes emissions associate with equipment and energy needed, if any, to physically restore the natural landscape (i.e. ‘plug’ drainage passages).	Controlled
SS2	Upland Soil	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O, and including net sequestration if occurring) associated with upland soils. This soil may be cropped or in perennial forage.	Controlled
SS3	Conserved or Restored Wetland Margin	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O, and including net SOC sequestration) associated with conserved or restored wetland margin.	Controlled
SS4	Conserved or Restored Wetland Basin	GHG dynamics (net flux of CO ₂ , CH ₄ and N ₂ O) of the conserved or restored wetland.	Controlled
SS5	Mechanized Equipment – Energy Consumption for Crop Transportation	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the offsite transportation of crop or crop products, including forages, to the point of sale or final use.	Controlled
SS6	Fuel Production and Transportation	GHG Emissions of CO ₂ , CH ₄ and N ₂ O are generated from the upstream exploration, production processes and distribution of diesel and other fuels.	Related
SS7	Materials and Equipment Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated from the input of materials and energy in the manufacturing and distribution of materials and equipment.	Related

SS8	Seed Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are generated in the process of collecting, cleaning, storing and distributing seed for crops.	Related
SS9	Fertilizer and Lime Production and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacturing and distribution of fertilizer and lime.	Related
SSR10	Mechanized Equipment – Energy Consumption for Crop Processing and Distribution	GHG emissions associated with the cleaning, handling and final distribution of crop products, including forages.	Related
SS11	Pesticide Manufacture and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacture and off site transportation of pesticide	Related
SS12	Herbicide Manufacture and Distribution	GHG emissions of CO ₂ , CH ₄ and N ₂ O are associated with the manufacture and off site transportation of herbicide.	Related
SS13	Livestock Emissions	GHG emissions of N ₂ O and CH ₄ and are associated with the manure of grazing animals. Enteric emissions of CH ₄ are produced as a by-product of digestion that are exhaled or eructated from the grazing livestock.	Controlled
SS14	Fencing and Watering Materials and Installation	GHG Emissions of CO ₂ , CH ₄ and N ₂ O are associated with the energy and materials required to fence the land and install watering facilities.	Controlled

Appendix B – Relevant SSs

IDENTIFIER	BASELINE (C, R, A)	PROJECT (C, R, A)	INCLUDE OR EXCLUDE	JUSTIFICATION FOR EXCLUSION FROM QUANTIFICATION
P SS1	N/A	Controlled	Exclude	This decision is conservative, because mechanized activity is expected to cease in the wetland basin under the project condition.
B SS1	Controlled	N/A	Exclude	
P SS2	N/A	Controlled	Exclude	The upland soil is excluded, because the proposed Wetlands Protocol is expected to require that the upland is managed according to a complementary GHG quantification protocol. This means the upland soil emissions (and reductions, if any) will be included in the quantification of the complementary protocol.
B SS2	Controlled	N/A	Exclude	
P SS3	N/A	Controlled	Include	Not excluded — reductions and removals quantified in this SS represent the core of the proposed Wetlands Protocol.
B SS3	Controlled	N/A	Include	
P SS4	N/A	Controlled	Include	Not excluded — reductions and removals quantified in this SS represent the core of the proposed Wetlands Protocol.
B SS4	Controlled	N/A	Include	
P SS5	N/A	Controlled	Exclude	This decision is conservative, because mechanized activity is expected to cease in the wetland basin under the project condition.
B SS5	Controlled	N/A	Exclude	
P SS6	N/A	Related	Exclude	This decision is conservative, because mechanized activity is expected to cease in the wetland basin under the project condition.
B SS6	Related	N/A	Exclude	
P SS7	N/A	Related	Exclude	This decision is conservative, because mechanized activity is expected to cease in

B SS7	Related	N/A	Exclude	the wetland basin under the project condition.
P SS8	N/A	Related	Exclude	These emissions are expected to be equivalent in baseline or project.
B SS8	Related	N/A	Exclude	
P SS9	N/A	Related	Exclude	These emissions are expected to be equivalent in baseline or project.
B SS9	Related	N/A	Exclude	
P SS10	N/A	Related	Exclude	These emissions are expected to be equivalent in baseline or project.
B SS10	Related	N/A	Exclude	
P SS12	N/A	Related	Exclude	These emissions are expected to be equivalent in baseline or project.
B SS12	Related	N/A	Exclude	
P SS13	N/A	Controlled	Exclude	Not all baselines or projects will involve livestock, but if present the livestock or the forages they consume are expected to be required to be managed under a complementary GHG reduction quantification protocol. This means the livestock emissions will be included in the quantification of the complementary protocol.
B SS13	Controlled	N/A	Exclude	
P SS14	N/A	Controlled	Exclude	Not all baselines or projects will involve livestock, but if present these emissions are expected to be equivalent in the baseline and project, or will be too small to merit quantification.
B SS14	Controlled	N/A	Exclude	