NATURAL FORCES DEVELOPMENTS LP

Wetland Appendix 2021-2022

Westchester Wind Project

December 2022 – 22-4065

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December 14, 2022

Natural Forces Developments LP
Westchester Wind Project
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Attention: Megan MacIsaac

Wetland Appendix: 2021-2022 Wetland Surveys and Functional Assessments for the Westchester Wind Project

Dillon Consulting Limited (Dillon) is pleased to provide you with the final report for the delineation surveys and functional assessments for wetlands that were conducted as part of the environmental assessment for the Westchester Wind Project.

We trust the following meets your present needs. If you have any questions or comments, please contact the undersigned at (902)-450-4000 ext. 5052 at your convenience.

Sincerely,

DILLON CONSULTING LIMITED

Kelly Regan, M.Sc.
Project Manager, Associate

KSR:emw
Enclosure

Our file: 22-4065

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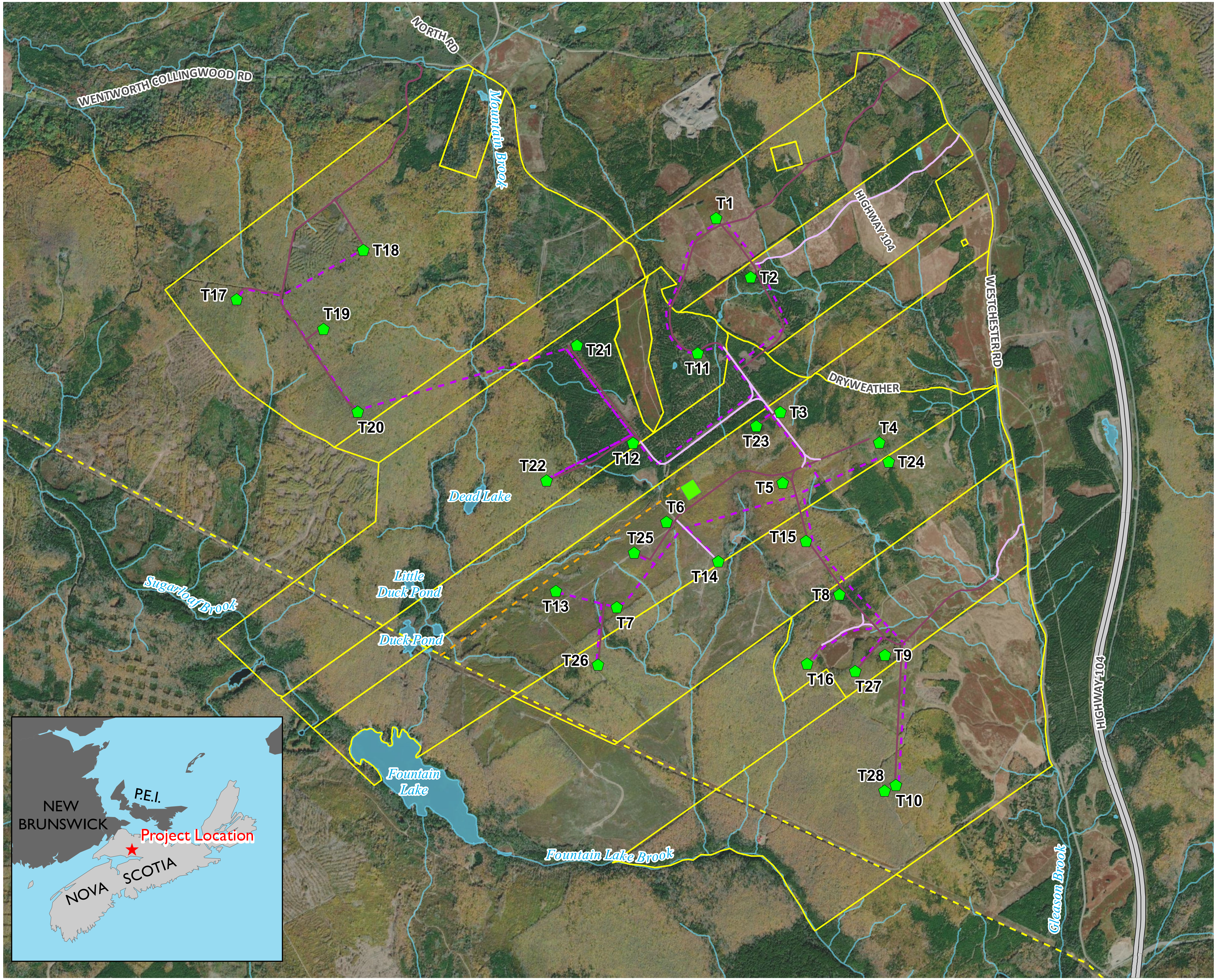
1.0 Introduction

Dillon Consulting (Dillon) was retained by Natural Forces Developments Limited Partnership (the Proponent) on behalf of the Westchester Wind Limited Partnership to complete natural environment surveys in support of the development of a Nova Scotia Environmental Assessment Registration Document (EARD) and associated Addendum for the Westchester Wind Project (the Project). The Project is being developed and will be owned and operated by the Westchester Wind Limited Partnership, a partnership between Natural Forces Developments Limited Partnership (referred to herein as the Proponent or Natural Forces) and Wskijnu'k Mtmo'taqnuow Agency Limited (the Agency), a corporate body wholly owned by the 13 Mi'kmaw bands in Nova Scotia. Natural Forces acts on behalf of the Westchester Wind Limited Partnership for many aspects of Project development.

The Project consists of up to 12 wind turbine generators (WTGs) capable of producing up to 50 MW of renewable energy that will be connected to the existing Nova Scotia Power transmission grid via an overhead transmission line, as well as a substation (Figure 1). The Project is located on a mixture of privately owned blueberry fields, previously forested land and undeveloped forested land in Cumberland County near the communities of Westchester Station, Rose, and Londonderry.

The proposed project is located in an area where wetlands are present. Wetlands are considered important features and valued environmental components (VECs) because they are valued in their relationship with other wildlife and wildlife habitat, including other biological and physical components addressed as VECs in this environmental assessment (EA). Natural environment surveys for the Project were conducted for VECs that were identified based on an understanding of the environmental features of the proposed project area, the nature of the Project, and the potential interactions that may occur between the proposed project and the environment/VECs.

Taking into consideration the objectives of the EARD, this report provides an effects assessment on wetlands, and includes: a brief overview of the proposed Project; a description of the scope and methodology used for the wetland surveys; a summary of the survey results; and, an assessment of residual effects (including potential interactions and mitigation) of the proposed Project on wetlands.



Natural Forces

WESTCHESTER WIND PROJECT

PROJECT LOCATION AND SITE LAYOUT

FIGURE 1

- Proposed Turbine Location
- Proposed Substation Location
- Property Lines
- Roads to be Upgraded
- Proposed Access Roads
- Proposed Collector Network
- Proposed Interconnection Line
- Transmission Line
- Highway
- Watercourse
- Waterbody

0 0.25 0.5 1 km SCALE 1:24,994

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: DU
MAP CHECKED BY: KB
MAP PROJECTION: NAD 1983 UTM ZONE 20N

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PROJECT: 21-1329

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1.1 Background

Wetlands are important to maintaining the health of watersheds by moderating floods, reducing the rate of runoff, and minimizing sedimentation and erosion (Nova Scotia Environment (NSE) 2019). Other important functions of wetlands include:

- Buffering storm water runoff and supporting natural drainage patterns;
- Sequestration and storage of atmospheric carbon;
- Supporting the production of peat and natural foods;
- Filtering organic waste, bacteria, excess nutrients, contaminants, and silt from water;
- Providing critical habitat for fish, wildlife, and plants, including Species of Conservation Concern (SoCC) and Species at Risk (SAR), includes globally significant coastal plain flora in Nova Scotia);
- Protecting the coastline from storm surges;
- Storing and releasing surface water and recharging groundwater, thereby contributing to drinking water supply;
- Supporting medicinal and ceremonial plants important to Mi'kmaq bands in Nova Scotia; and
- Supporting abundance and diverse plant communities which release essential food web nutrients after decomposition (NSE 2019).

Nova Scotia's wetlands have been given specific protection pursuant to the Nova Scotia Environment Act and the Nova Scotia Wetland Conservation Policy (NSECC 2019). The Nova Scotia Wetland Conservation Policy and regulatory processes are guided towards the goal of achieving no net loss of wetland function (NSE 2019). Wetland compensation for alterations of a delineated wetland is often required as a condition of a wetland alteration permit when a net loss of wetland function occurs. In addition to the protection provided to wetlands through the Nova Scotia Wetland Conservation Policy, the Federal Policy on Wetland Conservation (Government of Canada 1991) is applicable if: the Project is located on federal lands, federal funding is provided for the Project, or if federal decisions or approvals related to wetlands are required for the Project. In the case of the Project, there are no triggers for the Federal Policy on Wetland Conservation to be implemented.

The federal and provincial legislation that could apply to the Project include (but may not be limited to):

- *Canadian Environmental Protection Act* and regulations (ECC 1999);
- *Species at Risk Act* (ECCC 2002);
- *Transportation of Dangerous Goods Act*, and regulations (TC 1992);
- Nova Scotia *Environment Act* and regulations (NSECC 1994-95);
- Nova Scotia *Water Resources Protection Act*, and regulations (NSECC 2000);
- Nova Scotia *Endangered Species Act*, and regulations (NSECC 1998a);
- Nova Scotia *Wilderness Areas Protection Act*, and regulations (NSECC 1998b); and
- Contingency Planning Guidelines (NSECC 2021).

The Nova Scotia Wetland Conservation Policy also outlines the definition of Wetlands of Special Significance (WSS). WSS are wetlands or areas of a wetland that play a particularly important role in providing ecosystem services or functions, such as protecting drinking water supplies or supporting SAR or SoCC.

The Wetland Conservation Policy outlines an objective of preventing any loss of WSS. The following are considered WSS:

- Salt marshes;
- Wetlands within or partially within a Ramsar site, Wildlife Management Area, provincial park, nature reserve, wilderness area, or lands owned or protected by conservation land trusts;
- Wetlands that are project sites under the North American Waterfowl Management Plan and are secured for conservation;
- Wetlands in protected water areas (outlined in Section 106 of the Nova Scotia *Environment Act*); and
- Wetlands that are known to support SAR designated under the federal *Species at Risk Act* (SARA) or the Nova Scotia *Endangered Species Act* (NSESA; NSE 2019). NSECC will also consider classifying other wetlands as WSS if they: support high wildlife biodiversity or significant species assemblages, have significant hydrological value, or have high importance socially or culturally (NSE 2019).

1.2 Purpose and Objectives of the Report

This report provides a summary of the wetland surveys and functional assessments conducted as part of the biophysical surveys undertaken in support of the Project Environmental Assessment registration. This report includes the following:

- Brief description of the Project;
- Description of the scope and methodology used for the survey and functional assessment;
- Summary of the approach used to evaluate the data;
- The results of the surveys and functional assessment; and
- An assessment of residual effects (including potential interactions and mitigation) of the proposed Project on wetlands.

2.0 Project Description

The following is a high-level summary of the Project. Please refer to the Westchester Wind Project Environmental Assessment Registration Document Addendum (the Addendum) dated December 2022 for further information.

The Project is located on Westchester Mountain in Cumberland County, Nova Scotia. The Project is proposed to have an installed capacity of up to 50 MW, amounting to up to 12 wind turbine generators and associated infrastructure, including an electrical substation, collector lines, and overhead transmission line (Figure 1).

The Project will be located predominantly on privately-owned lands used for blueberry farming, forestry, maple groves, and recreation (i.e., snowmobile trails). An easement will be required over a 300 m stretch of Crown land along an existing access road. The forestry activities include previously forested land at varying stages of regeneration, as well as undeveloped forested lands owned by forestry companies. In addition, the Project site met crucial factors that determined suitability, which included features such as the strength and consistency of the wind resources and its proximity to existing electrical and civil infrastructure. The Project site was selected due to the existing mixed anthropogenic land uses and historical anthropogenic impacts in these areas, in order to minimize impacts to undeveloped lands to the extent feasible.

The purpose of the Project is to contribute to Nova Scotia achieving their renewable electricity targets through the generation of clean and renewable energy. Not only will this have environmental benefits, but will also reduce Nova Scotia's reliance on imported energy sources through the development of a localized renewable energy generation (Renewable Electricity Regulations 2021).

3.0 Scope of Work

To support the assessment of the potential effects of the Project on wetlands, the scope of work for the wetland surveys was based on the recommended approach outlined in the Nova Scotia Wetland Conservation Policy (NSE 2019). Wetlands in Nova Scotia are defined by the Environment Act as land periodically or permanently has a water table at, near or above the land's surface, or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions (NSE 1994-95). This includes lands commonly referred to as marshes, swamps, fens, and bogs, each of which has unique ecological conditions (NSE 2019). Other characteristics of wetlands include water at or near the surface that is less than 2 m deep, little to no current, flora and fauna that thrive in wet environments, and rich mineral soils or peat formed where water saturates or floods the surface (NSE 2019).

The scope of the Project wetland survey included:

- Initial desktop assessment of wetlands within a Local Assessment Area (LAA) to identify potential locations of wetlands and inform, and refine, the field surveys (**Figure 2**);
- Delineation and classification of wetlands through field surveys completed within the study area of a 30 m buffer of the Potential Development Area (PDA; see **Figure 2**); and
- Functional assessment of wetlands in the study area that have the potential to be impacted.

3.1 Spatial Boundaries

For the purpose of the wetland surveys conducted as part of the biophysical baseline for the Project, the spatial boundaries included the PDA, the LAA, and the study area and are described in Table 1. A 30 m wide protective buffer of natural, undisturbed vegetation around a wetland is encouraged to protect wetlands from the impact of outside threats such as anthropogenic disturbance, and serves as important habitat for wildlife (New Brunswick Department of Environment and Local Government (NBDELG) 2002).

Table 1: Spatial Boundaries for the Assessment of Wetlands

Assessment Area	Definition	Purpose of Boundary
Potential Development Area	Area encompasses the Project footprint and a buffer of 15 m on either side of shoulders of roadways (either existing or new), collector lines and transmission line, a 75 m buffer around the base of each turbine location, and a 25 m buffer around the substation.	Represents the extent of anticipated areas that could undergo physical disturbance associated with the Project. This area encompasses the proposed 28 turbines locations and their associated infrastructure. However, the completed Project would consist of up to 12 of those

Assessment Area	Definition	Purpose of Boundary
		locations and their associated infrastructure.
Study area	Area encompasses wetlands located within 30 m of the PDA.	The area included in a focused survey on foot. Observations in the study area are extrapolated and applied to understand potential effects of the Project on the full LAA.
Local Assessment Area	Area encompasses a buffer of 500 m around the PDA and was selected to capture wetlands and wetlands connected to watercourse with crossings within 30 m of the PDA and their associated tributaries or distributaries.	The anticipated maximum area where Project-specific environmental interactions can be predicted and measured with a reasonable degree of accuracy and confidence (i.e., the zone of influence of the Project on each VEC).

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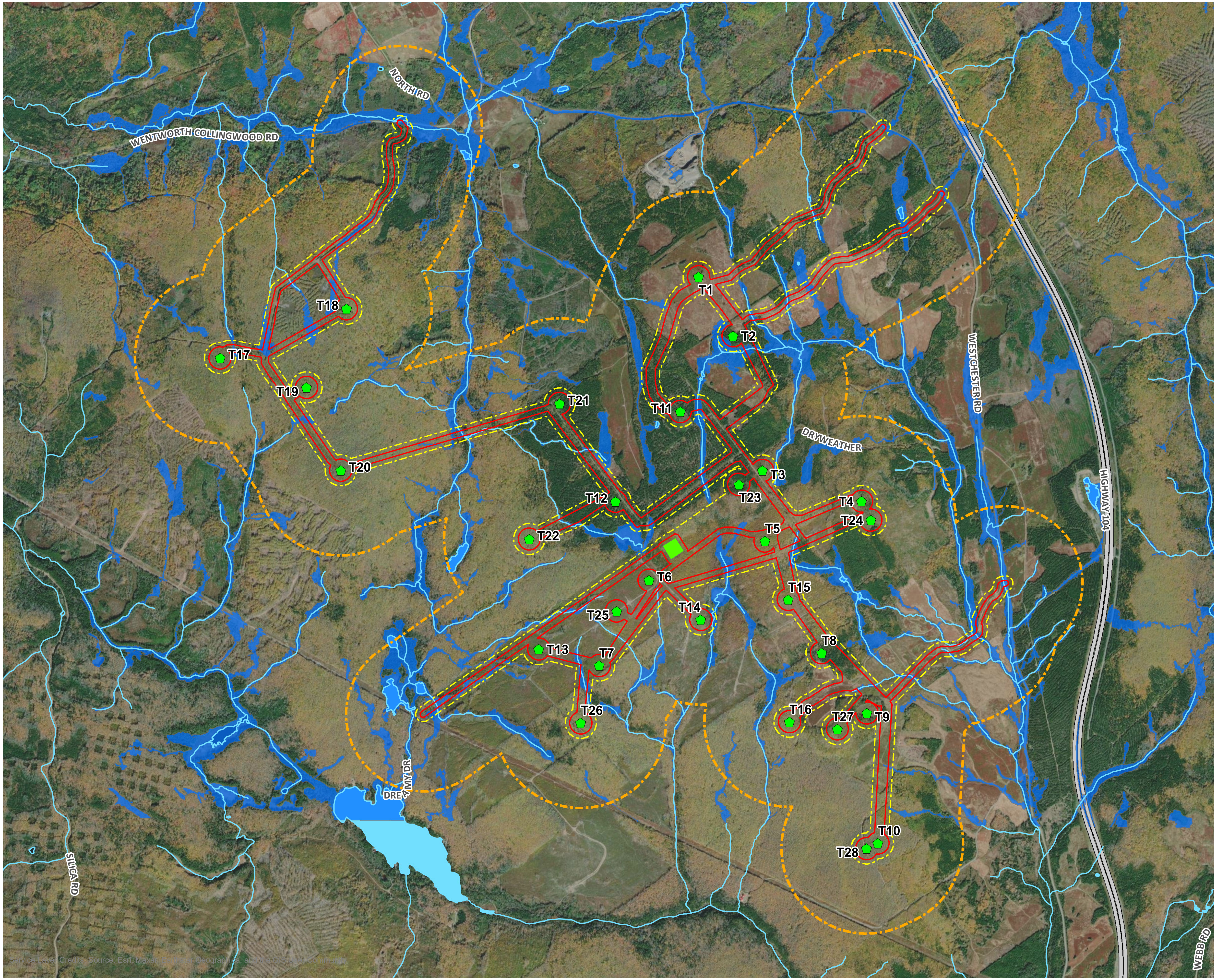
WESTCHESTER WIND PROJECT

WETLANDS WITHIN THE STUDY AREA

FIGURE 2



- Proposed Turbine Location
- Proposed Substation Location
- Potential Development Area (PDA)
- Study Area
- Local Assessment Area (LAA)
- Predicted Wet Area Model
- Watercourse
- Waterbody

0 0.25 0.5 1 km

SCALE 1:25,000

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DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

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4.0 Methods

4.1 Desktop Wetlands Assessment Methods

Prior to field assessments, Dillon reviewed readily-available public information from reputable sources to inform existing conditions of the Project LAA and to guide the field surveys. The following sources were reviewed:

- Google Earth® satellite imagery;
- The Nova Scotia Wetlands Inventory (NSDNRR 2021a); and
- Publicly-available geographic information systems (GIS) map layers.

High-resolution Google Earth imagery was available for the site from August 2021, September 2014, June 2017, July 2019 and August 2021. The imagery was primarily reviewed for recent changes in land use (e.g., logging), and features or vegetation's types which could indicate wetlands.

4.1.1 Wet Areas Model (WAM)

A site-specific wet areas model (WAM) was developed by Dillon using GIS to predict potential watercourse and wetland crossings not mapped in provincial wetland watercourse datasets. Development of the model relied heavily on the availability of Light Detection and Ranging (LiDAR) Digital Elevation Models (DEM), which are freely available in Nova Scotia. As part of the modelling, a flow accumulation analysis was completed to determine the upstream area that flows into each cell (a 1 m by 1 m grid) within the study area. Using these data and applying a suitable threshold (i.e., greater than 100,000 upstream cells) is a useful predictor of watercourses, potential watercourses, and drainage channels within LAA. The potential watercourses and drainage channels are then used as an input into potential wet areas modeling as an additional source of known mapped water features.

Wet areas modeling compares the elevations of each cell in a study area against the elevation of the nearest known mapped water features (e.g., lakes, rivers, wetlands, etc.) Where there are slight differences in the ground elevation against the elevation of these water features (e.g., less than 1 m in the DEM), these areas can be good predictors of potential wet areas.

4.2 Field Survey Methods

The wetland field survey included the delineation, classification and functional assessment of wetlands within 30 m of the PDA. Field surveys of the wetlands in the study area were conducted by qualified professionals experienced in wetland delineation and functional assessment. The preliminary wetland surveys were conducted between June 1, 2021 and September 30, 2021 to classify and delineate the wetlands present within the study area. Following updates to the Project layout, the study area for the wetland assessment was expanded in 2022. In July 2022, the wetlands in the updated study area were classified and delineated. A functional assessment of wetlands within the study area was conducted concurrently and is detailed below.

4.2.1 Wetland Delineation

The methods of wetland determination and delineation used in the wetland surveys were based upon established protocols for wetland delineation, in particular, the U.S. Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987/2010). Wetland Delineation Data Sheets that were adapted from U.S. Army Corps of Engineers form for Northeast-North Central Supplement for use in Nova Scotia (2011) were used to record data collected in the field. Wetland determination and delineation primarily focused on establishing the wetland-upland edge and was based on the presence of positive indicators for three parameters:

- Hydric (wet) soil conditions;
- Hydrophytic (wet adapted) vegetation; and
- Wetland hydrology.

Soil sampling is performed to a depth of at least 50 cm (or to a point of refusal, such as bedrock) to assess wetland soils for hydric soil conditions. Soil horizons are documented in terms of their texture, thickness, colour (Munsell value/chroma/hue), and presence of hydric soil indicators (when applicable). Hydric soil indicators (e.g., gleyed matrix, redox features) were determined following the Field Indicators of Hydric Soils in the United States (USACE 2012) guide.

For each wetland, a minimum of one plant plot was assessed to confirm the dominance of hydrophytic vegetation. For each wetland plant plot, plant species observed were analyzed at three strata (tree, shrub, and herbaceous) and were documented in terms of their percent (%) cover within a given plot size (10 m, 5 m, and 2 m radius, respectively). Wetland indicator status for plant species observed within the plant plots were determined as per United States Department of Agriculture (USDA) Region 1 (Nova Scotia and New Brunswick) listings for interpreting USDA Wetland Indicator Status (USACE 2012).

At each wetland soil sampling pit and over the greater area of the wetland, observations were made on the wetland hydrological regime. To determine the hydrological regime, the wetland context, site location, and microtopography of the wetland area were taken into consideration. Both primary and secondary hydrology indicators were recorded, if present, at each wetland. To confirm hydric soil conditions, at least one primary hydrology indicator (e.g., surface water, a high water table, soil saturation, and sediment deposits) must be present. Secondary indicators used (of which two are required in the absence of a primary indicator) include surface soil cracks, drainage patterns, moss trim lines, and drift or sediment deposits, among others (USACE 2012).

4.2.2 Wetland Functional Assessment

Wetland functional assessments were completed at all 15 wetlands within the study area (shown on Figure 3A-F). The assessments followed a standardized method for assessing natural wetland functions and benefits called the Wetland Ecosystems Services Protocol for Atlantic Canada (WESP-AC) (NBDELG 2018). WESP-AC represents a standardized approach to the way data is collected and interpreted to indirectly yield relative estimates of a wide variety of important wetland functions and their associated benefits. The functional assessments were completed during the months of July-September in 2022, consistent with the protocol requirement of assessments occurring prior to site construction and within the growing season (approximately June 1 – September 30). The results of the WESP-AC functional assessment provided a classification for assessed wetlands based on their functionality as well as the identification of WSS.

The WESP-AC scoring (i.e., 0 to 10) and ratings (i.e., “Lower”, “Moderate”, or “Higher”) were assigned to a variety of wetland functions based on visual assessments of weighted ecological indicators (Adamus 2018). The number of ecological indicators applied to estimate a particular wetland function depended on which functions were assessed as part of the field surveys. The indicators were then combined in a spreadsheet using logic-based, mathematical models to generate the score and rating for each wetland function and benefit (NSDNRR 2021). Together, this information provided a profile of functions and benefits provided by each assessed wetland.

Wetland functions are summarized as grouped functions in the WESP-AC calculator. For each wetland function, the scores and ratings represent a particular wetland’s standing relative to those in a statistical sample of non-tidal wetlands previously assessed in the province (121 calibration wetlands in NS; NBDELG 2018). Table 2 provides a list of various wetland functions by summary group, including their definitions and potential hydrological, biochemical, and ecological benefits of the wetland functions.

Table 2: Benefits of Grouped Wetland Functions Scored by WESP-AC

Function	Definition	Potential Benefits
Hydrologic Group		
Water Storage and Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	• Flood control • Maintenance of ecological systems
Water Quality Support Group		
Sediment Retention and Stabilization	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil.	• Maintain quality of receiving waters • Protect shoreline structures from erosion
Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season).	• Maintain quality of receiving waters
Nitrate Removal and Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	• Maintain quality of receiving waters

Function	Definition	Potential Benefits
Carbon Sequestration	The effectiveness for retaining particulate and dissolved carbon, and converting carbon dioxide gas to organic matter (particulate or dissolved).	• Maintain quality of receiving waters
Aquatic Support Group		
Stream Flow Support	The effectiveness for contributing water to streams, especially during the driest part of a growing season.	• Support fish and other aquatic life
Aquatic Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	• Support salmon and other aquatic life • Maintain regional biodiversity
Organic Nutrient Transport	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	• Support food chains in receiving waters
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	• Support cold water fish and other aquatic life
Aquatic Habitat Group		
Anadromous Fish Habitat	The capacity to support an abundance and diversity of native anadromous fish species.	• Support recreational and ecological values • Support salmon and other aquatic life
Resident Fish Habitat	The capacity to support an abundance and diversity of native non-anadromous fish species.	• Support recreational and ecological values • Support aquatic life
Amphibian and Turtle Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, or turtles.	• Maintain regional biodiversity.
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	• Support hunting and ecological values. • Maintain regional biodiversity
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	• Maintain regional biodiversity
Transition Habitat Group		
Songbird, Raptor, and Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	• Maintain regional biodiversity

Function	Definition	Potential Benefits
Pollinator Habitat	The capacity to support pollinating insects and birds.	• Maintain regional biodiversity and food chains
Native Plant Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	• Maintain regional biodiversity and food chains.

Notes:
Source: NSDNRR 2021.

4.3 Assessment of Wetlands of Special Significance

Wetlands within the study area were evaluated for their potential for meeting the criteria of a WSS. WSS are defined within Nova Scotia's Wetland Conservation Policy as wetlands that play particularly important roles in providing ecosystem services or functions (NSECC 2019). Based on the Policy, this includes the following wetland types:

- Salt marshes;
- Wetlands that are within or partially within a designated protected or managed area (as defined in the Policy);
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation;
- Wetlands known to support SAR; and
- Wetlands in designated protected water areas.

Additionally, the following characteristics, functions and services were considered in the evaluation of WSS within the study area:

- Wetlands that support a significant species or species assemblages (e.g., coastal plain flora),
- Wetlands that support high wildlife biodiversity;
- Wetlands that have high hydrologic value; and
- Wetlands that have high social or cultural importance.

For this EARD, the following definitions apply:

- Species at risk (abbreviated SAR): A species that is determined to be Endangered, Threatened, or Vulnerable/Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Nova Scotia *Endangered Species Act* (NSESA), or the federal *Species at Risk Act* (SARA); and
- Species of conservation concern (abbreviated SoCC): those species that are not SAR but are identified as regionally vulnerable or imperilled by the AC CDC (i.e., those species with AC CDC S-ranks of S1: Critically imperiled in province; S2: Imperiled in province; and S3: Vulnerable) in province of Nova Scotia

The wetlands were evaluated for the potential of being WSS in addition to functional assessment using the WESP-AC. Although the excel model used for the WESP-AC assessments includes an interpretation tool to classify WSS based on wetland functionality, it is recognized that the tool currently does not consider all aspects of WSS that are considered under the provincial Wetland Conservation Policy. As such, following completion of WESP-AC assessment wetlands were reviewed to see if they fall under the definition of WSS per the provincial Wetland Conservation Policy.

5.0 Results

5.1 Desktop Survey Results

Desktop assessment and the wet areas model identified the potential for wetlands to be located in the LAA (see Figure 2, above). The desktop-based analysis constraints mapping informed an avoidance-based design approach for the Project layout. Wetlands whose boundaries were predicted to overlap with the study area were then ground-truthed during the 2021 and 2022 field seasons to identify, delineate and conduct functional assessments. The results of the field surveys, which were informed by the results of the desktop survey are presented in the following section (Section 5.2).

5.2 Wetland Delineation

Based on the wetland assessments conducted between 2021 and 2022, 15 wetlands were identified that were entirely within or had a portion of their area within a 30 m buffer of the PDA (Figures 3A-D.) For wetlands that extended beyond the study area, the entire wetland was either field delineated if feasible or the portion of the wetland outside the study area was modeled based on the site-specific WAM. The 15 surveyed wetlands are shown on Figures 3A-D and their general characteristics are summarized in Table 3.

Table 3: Summary of Wetlands Characteristics

Wetland ID	Wetland Type	Total Wetland Area (ha)	Water Flow Path	Landscape Position	Landform
Wetland 1	Treed Swamp	0.03	Throughflow-intermittent	Lotic	Stream Fringe
Wetland 2	Wet Meadow/ Swamp	0.55	Outflow-intermittent	Terrene	Fringe (Pond)
Wetland 3	Treed Swamp	3.67	Throughflow-intermittent	Terrene	Flat
Wetland 4	Tree and Shrub Swamp	4.06	Throughflow-intermittent	Terrene	Flat
Wetland 5	Treed Swamp	0.51	Throughflow via WC3	Lotic	Stream Fringe
Wetland 6	Fen/Shrub Swamp	4.51	Throughflow	Lotic	Stream Fringe
Wetland 7	Fen	2.78	Throughflow	Lotic	Floodplain
Wetland 8	Hardwood Treed Swamp	0.10	Outflow-intermittent	Terrene	Basin
Wetland 9 (a & b)	Wet Meadow/Treed Swamp	0.06	Throughflow via WC2	Lotic	Stream Fringe

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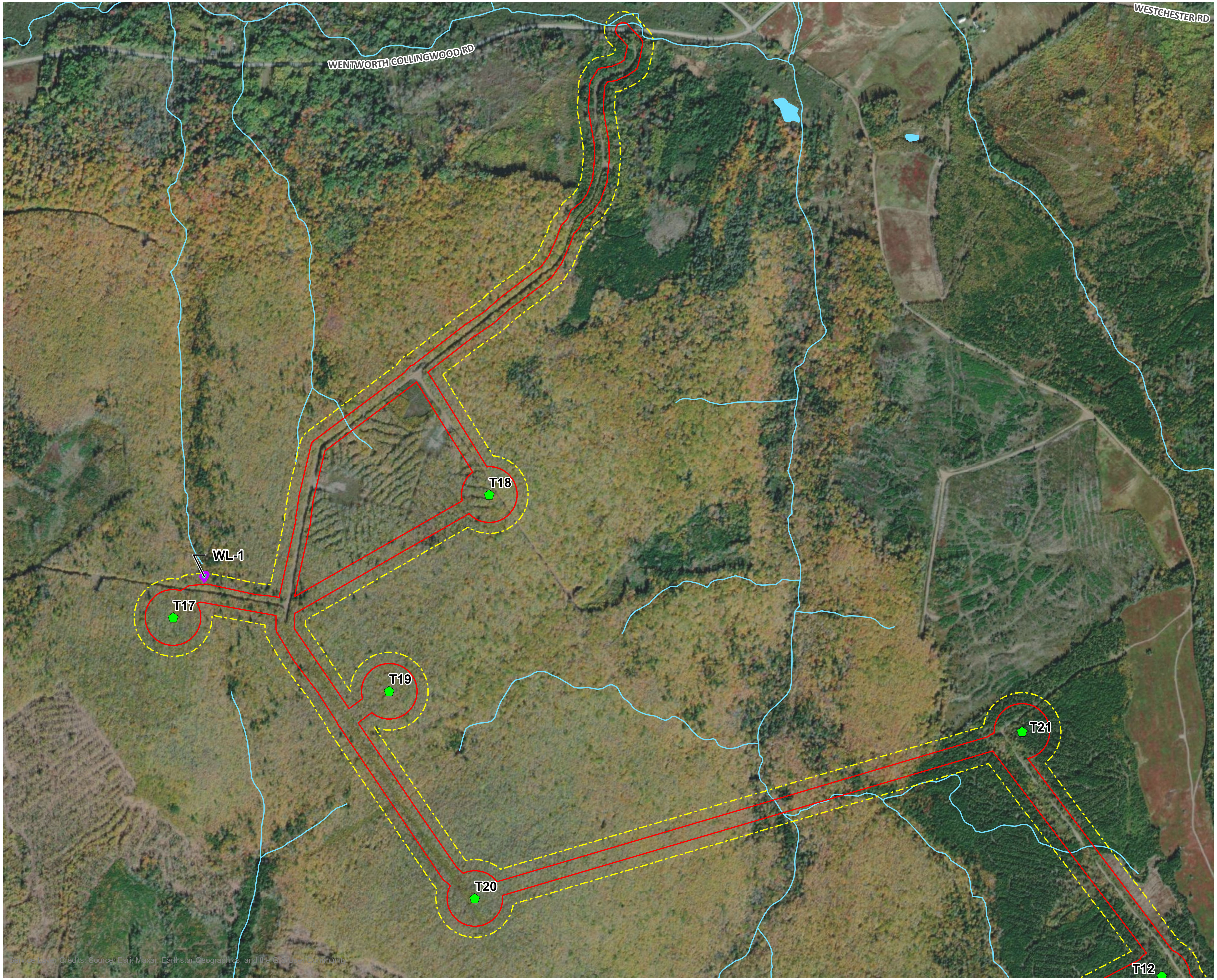
Wetland ID	Wetland Type	Total Wetland Area (ha)	Water Flow Path	Landscape Position	Landform
Wetland 10	Treed Swamp	0.89	Outflow-intermittent	Terrene	Basin
Wetland 11	Fen and Shrub Swamp Complex	2.5	Throughflow via WC11	Lotic	Stream Fringe
Wetland 12	Shrub Swamp	1.78	Throughflow via Gleason Brook	Lotic	Stream Fringe
Wetland 13	Treed Swamp	0.03	Throughflow via WC1	Lotic	Stream Fringe
Wetland 14	Treed Swamp	0.72	Throughflow via WC17	Lotic	Stream Fringe
Wetland 15	Treed Swamp	0.42	Throughflow-intermittent	Terrene	Flat
Total Area‡:		22.6			

‡Approximate total wetland area includes the delineated area of wetlands within the study area, as well as the predicted area extends beyond the study area, where applicable.

The majority of these wetlands (i.e., 12 of them) are classified as swamps based on the Canadian Wetland Classification System (National Wetlands Working Group 1997). Swamp wetlands within the study area are located on the fringes of flowing streams and intermittent watercourses and are dominated by mixed-wood and hardwood forests, many with a dense shrub layer of speckled alder (Alnus incana). Within the Study Area, identified swamp wetlands include a mixture of mixed-wood treed swamps, wet meadows and shrub swamps.

Three of the assessed wetlands are fen or fen/swamp complexes; WL-6, WL 7 and WL11 are classified as fens with shrub-dominated swamp components. These wetlands contained a dominant herbaceous strata comprising grasses, sedges and cinnamon fern and were enriched by throughflow streams.
As mentioned above, the Project layout was designed to avoid the placement of WTGs and their associated linear infrastructure within wetlands. Although 15 wetlands were identified within the study area, only 10 wetlands are anticipated to be partially located within the PDA (i.e., 1.6 ha or 7% of wetland area), as a result of avoidance-based project planning. A strategy for avoidance and potential alterations required for the wetlands that extend into the PDA is included in Table 4. With avoidance based planning, only three wetlands are predicted to be directly impacted by potential construction activities within the PDA. As previously noted, the Project would consist of up to 12 turbines and their associated infrastructure. As such, the impact area described is the maximum impact to any individual wetland. Final layout selection will work to minimize impacts to wetlands as much as feasible. The areas of wetlands in study area along with the proposed alterations and impacts are summarized below in Table 4.



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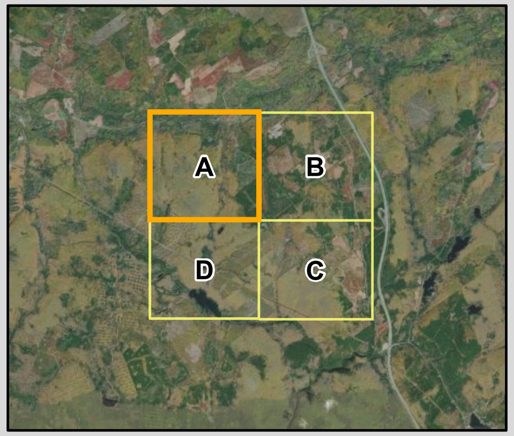
WESTCHESTER WIND PROJECT

WETLANDS WITHIN THE STUDY AREA

FIGURE 3A

- Proposed Turbine Location
- Proposed Substation Location
- Potential Development Area (PDA)
- Study Area
- Field Delineated Wetland Boundary
- Model Interpreted Wetland Boundary
- Watercourse
- Waterbody
- Highway



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SCALE 1:10,000

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STATUS: DRAFT

DATE: 2022-12-14

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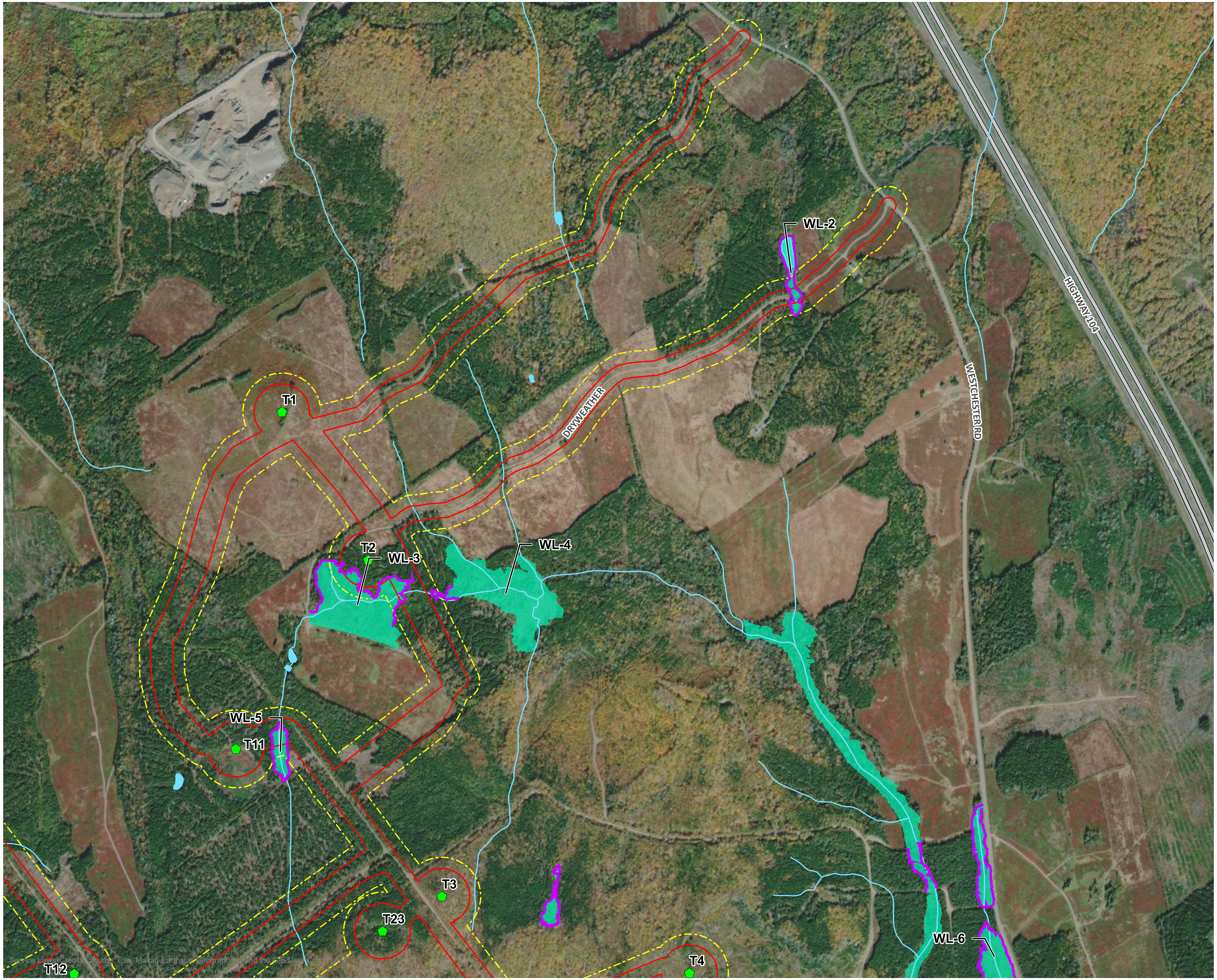


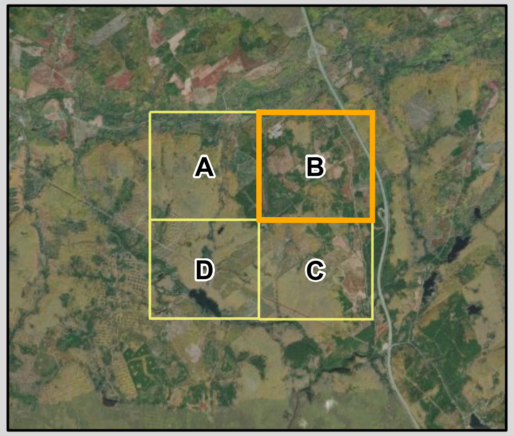
Natural Forces

WESTCHESTER WIND PROJECT

WETLANDS WITHIN THE STUDY AREA

FIGURE 3B

- Proposed Turbine Location
- Proposed Substation Location
- Potential Development Area (PDA)
- Study Area
- Field Delineated Wetland Boundary
- Model Interpreted Wetland Boundary
- Watercourse
- Waterbody
- Highway



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SCALE 1:10,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: DU
MAP CHECKED BY: KB
MAP PROJECTION: NAD 1983 UTM ZONE 20N

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PROJECT: 21-1329

STATUS: DRAFT

DATE: 2022-12-14

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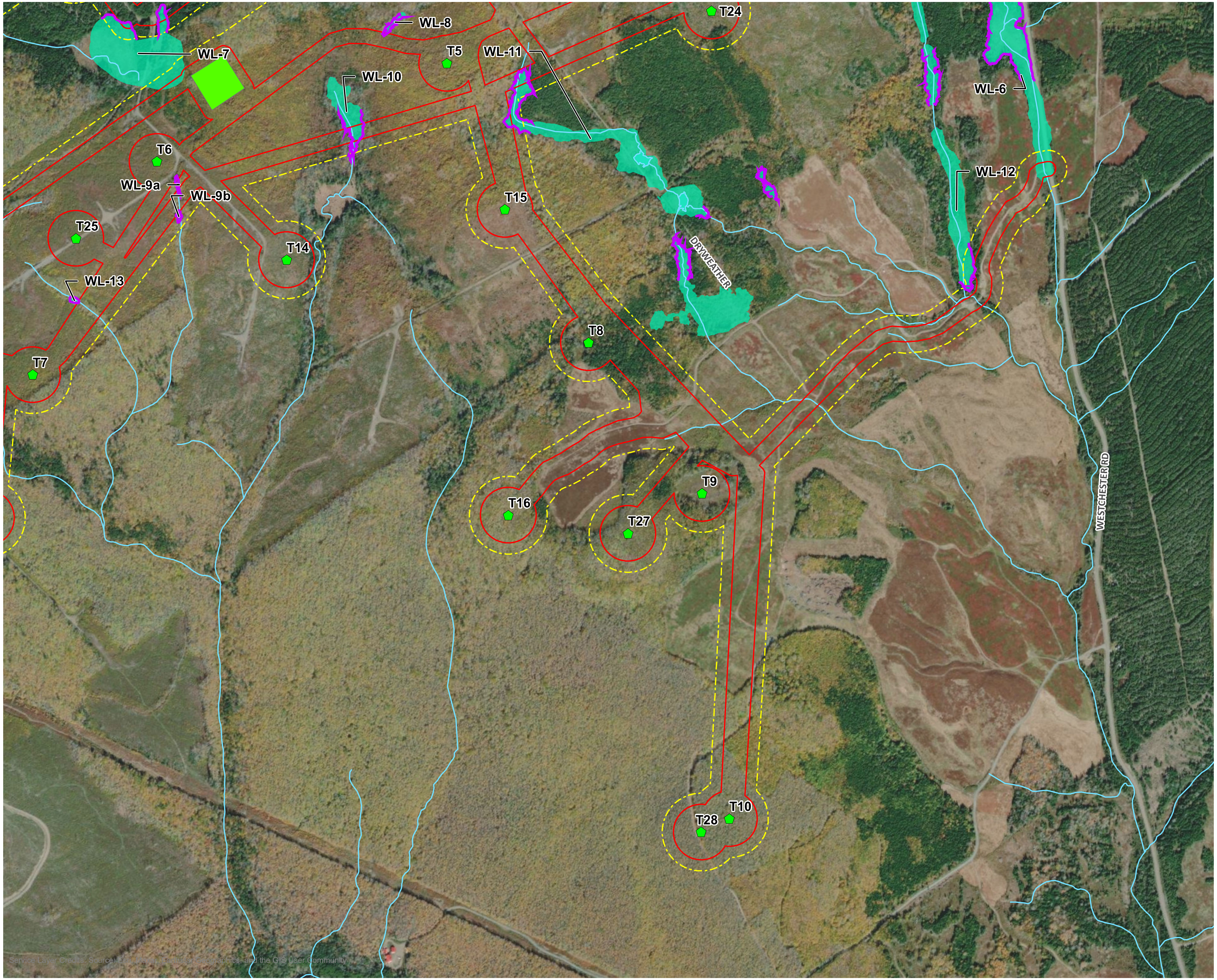


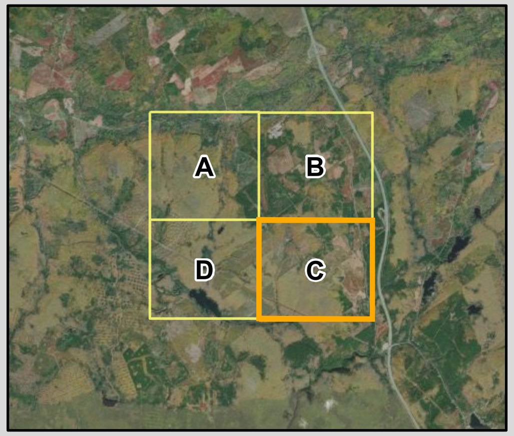
Natural Forces

WESTCHESTER WIND PROJECT

WETLANDS WITHIN THE STUDY AREA

FIGURE 3C

- Proposed Turbine Location
- Proposed Substation Location
- Potential Development Area (PDA)
- Study Area
- Field Delineated Wetland Boundary
- Model Interpreted Wetland Boundary
- Watercourse
- Waterbody
- Highway



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SCALE 1:10,000

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DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: DU
MAP CHECKED BY: KB
MAP PROJECTION: NAD 1983 UTM ZONE 20N

DILLON CONSULTING

PROJECT: 21-1329

STATUS: DRAFT

DATE: 2022-12-14

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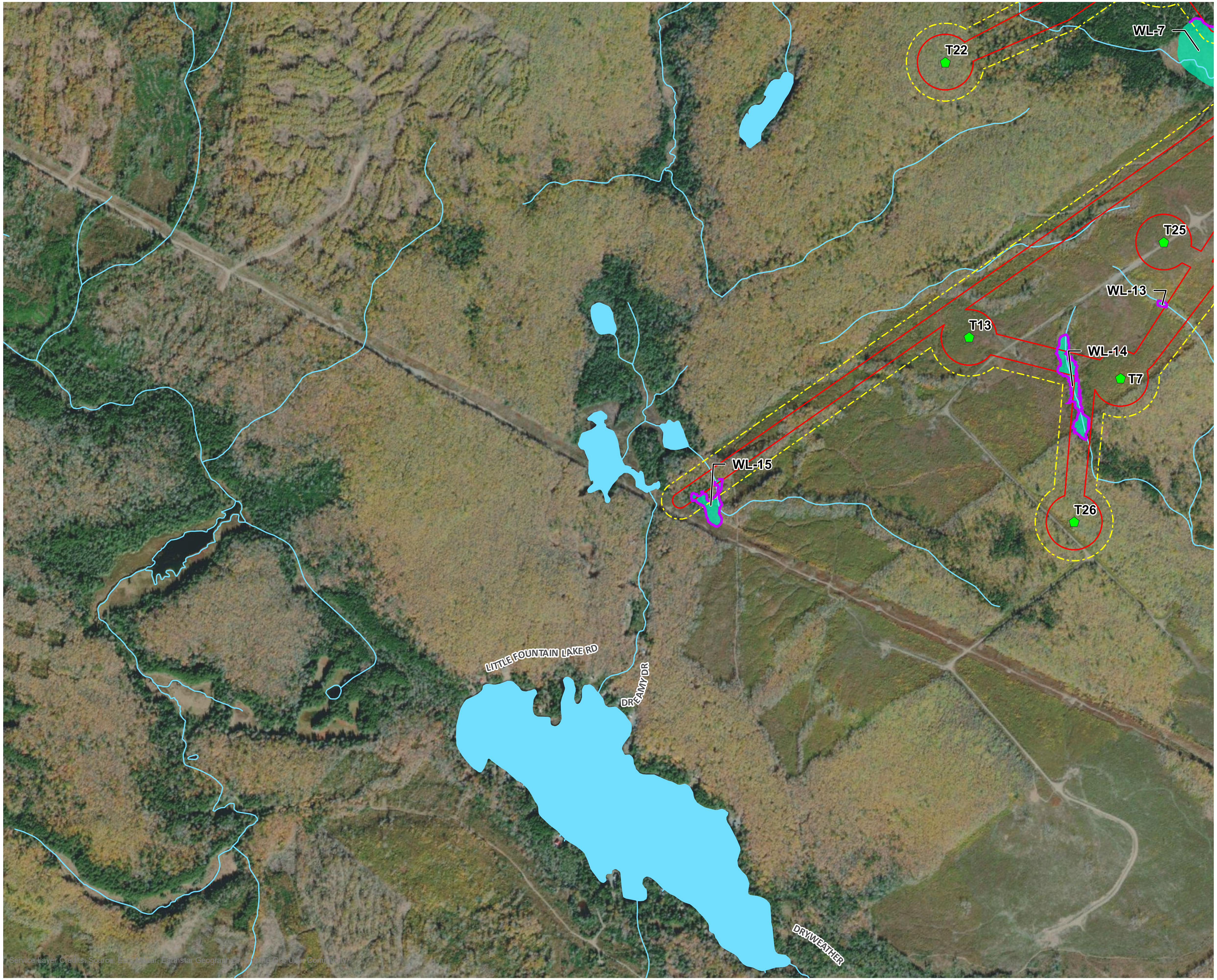


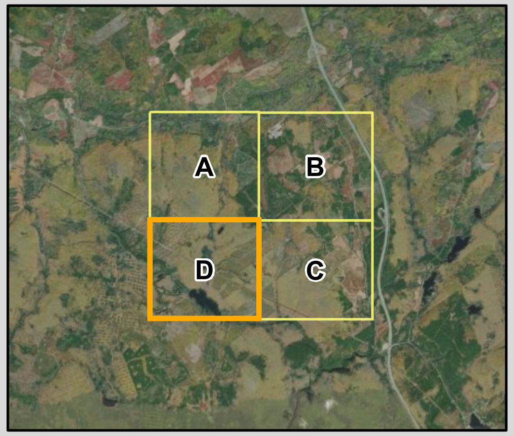
Natural Forces

WESTCHESTER WIND PROJECT

WETLANDS WITHIN THE STUDY AREA

FIGURE 3D

- Proposed Turbine Location
- Proposed Substation Location
- Potential Development Area (PDA)
- Study Area
- Field Delineated Wetland Boundary
- Model Interpreted Wetland Boundary
- Watercourse
- Waterbody
- Highway



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SCALE 1:10,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: DU
MAP CHECKED BY: KB
MAP PROJECTION: NAD 1983 UTM ZONE 20N

DILLON CONSULTING

PROJECT: 21-1329
STATUS: DRAFT
DATE: 2022-12-14

FILE LOCATION: K:\2021\211329\Product\Internal\Westchester_Figures_2022\Wetlands 2022\WC_F03_Wetlands_WithinSAandLAA_2022.mxd

Table 4: Summary of Wetlands and Proposed Alterations with 30 m of the PDA

Wetland ID	Wetland Area (ha)		Wetland % in the PDA	Potential Alteration/ Avoidance Strategy
	Total	Within PDA		
Wetland 1	0.03	0	0	None
Wetland 2	0.55	0.10	18	This wetland is crossed by an existing access road that may require upgrading before it can be used by the Project.
Wetland 3*	3.67	0.28	8	The edge of this wetland is located adjacent to a proposed access road. The final design of this across road should consider avoidance of this wetland. This wetland is located within the PDA near T2. With careful site planning, the crane pad and footprint of T2 will avoid this wetland. A collector line is proposed to run across the eastern lobe of this wetland. With careful site planning, the line can span this wetland.
Wetland 4*	4.06	0	0	None
Wetland 5	0.51	0.23	45	Partial Infill – This wetland will be crossed in one location by both a collector line and an access road for T11.
Wetland 6*	4.51	0.17	3.8	An existing access road that spans this wetland will be used as an access road for the Project. The final design should consider if the existing road requires upgrades. If so, upgrades should be considered that avoid altering, maintaining, restoring, or enhancing the potential WSS.
Wetland 7*	2.78	0.10	4	An existing access road that spans the eastern lobe of this wetland that will be used as an access road for the Project. The final design should consider if the existing road requires upgrades. If so, upgrades should be considered that avoid altering, maintaining, restoring, or enhancing the potential WSS.
Wetland 8	0.10	0.01	1	None
Wetland 9 (a & b)	0.06	0.03	50	A collector line is proposed to run between the lobs of this wetland. With careful site planning, the line can span this wetland.

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Wetland ID	Wetland Area (ha)		Wetland % in the PDA	Potential Alteration/ Avoidance Strategy
	Total	Within PDA		
Wetland 10	0.89	0.17	19	A collector line is proposed to run through this wetland. With careful site planning, the line can span this wetland and construction access may be possible using an adjacent access road.
Wetland 11*	2.5	0.14	6	One collector line is proposed to run through this wetland and a second line is located adjacent to this wetland. With careful site planning, the lines can span this wetland and construction access may be possible using an adjacent access road.
Wetland 12*	1.78	0	0	None
Wetland 13	0.03	0	0	None
Wetland 14	0.72	0.23	32	Partial Infill – This wetland will be crossed in two locations by both collector lines and access roads to T13, T7 and T36. With careful site planning, the lines can span this wetland and construction access may be possible using an adjacent access road.
Wetland 15	0.42	0.12	29	None – wetland is adjacent to proposed new interconnection line and can be avoided.
Total‡:	22.6	1.6	7%	

‡Approximate total wetland area includes the delineated area of wetlands within the study area, as well as the predicted area extends beyond the study area, where applicable.

5.3 Functional Assessment

The WESP-AC datasheets summary scores for the assessed wetlands are included in Appendix B and include a numerically weighted score for functions and benefits of 21 wetland functions and other attributes. WESP-AC functional assessment applies a three-level categorical rating (i.e., Lower, Moderate or Higher) and is based on natural breaks in the statistical distribution of scores among the calibration wetlands for each function or benefit, determined objectively using a statistical procedure known as Jenks Optimisation (Jenks 1967).

WESP-AC guidance states that the primary focus should be on the normalised function scores of the WESP-AC. However, normalised benefit scores are included as they include data associated with the context within which the associated function is being performed currently (e.g., they are influenced by current land uses). The following discussion includes a summary of the five grouped wetland functions considered by WESP-AC in the non-tidal calculator for wetland functional assessment. The ratings for grouped wetland functions in the study area are summarized in Table 5. A summary report of the functional assessment results, including normalized benefit ratings for individual wetlands, are provided in Appendix B.

Table 5: Summary of Normalized Function Ratings for Grouped Wetland Functions

Wetland ID	Hydrologic Group	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
Wetland 1	1.61*	3.04*	8.00	3.10*	6.74
Wetland 2	3.61	4.33*	5.25	7.15	5.30
Wetland 3*	1.54	3.14*	7.74*	6.61	8.45
Wetland 4*	2.43	4.06*	7.96*	7.57	8.19
Wetland 5	1.39*	4.10*	8.00	4.36	7.92
Wetland 6*	1.91*	3.33*	7.05*	5.93*	7.38*
Wetland 7*	2.44	4.18*	7.96*	6.71	9.00
Wetland 8	3.26	3.01	6.98	3.83	7.07
Wetland 9a/b	3.17*	3.23	7.75	4.16	7.76
Wetland 10	2.12	3.32	5.96	4.08*	8.77
Wetland 11*	0.60*	3.85*	8.54*	7.47	7.67*
Wetland 12*	1.43*	3.01*	7.13*	7.99	7.99*
Wetland 13	2.14	2.37*	6.01	3.28	7.31
Wetland 14	1.57*	3.39	7.77*	3.70*	8.25
Wetland 15	4.55	3.27*	5.44	3.68	7.64

Notes:

Lower‡ Moderate‡ Higher‡ *Normalized Benefits Rating of "Higher"

‡Based on WESP-AC scoring (i.e., 0 to 10) and ratings using weighted ecological indicators and using logic-based, mathematical models (indicators (Adamus 2018).

Grouped functions with values in orange and bold in Table 5 have a "higher" wetland normalized function and benefit scores based on the WESP-AC functional assessment conducted in 2022. Based on the data in Table 5, the following can be summarized:

- No wetlands were assessed a higher function and benefit for the Hydrologic Function group;
- No wetlands were assessed a higher function and benefit for the Water Quality Support function group;
- Seven wetlands (Wetlands 3, 4, 6, 7, 11, 12 and 14) were assessed as having a higher function and benefits for the Aquatic Support function group;
- No wetlands were assessed a higher function and benefit for the Aquatic Habitat function group; and
- Three wetlands (Wetlands 6, 11 and 12) were assessed as having a higher function and benefits for the Transition Habitat function group.

5.3.1 Hydrologic Functions

The hydrologic function of a wetland is defined by a wetland's contribution to ground and surface water resources. The WESP-AC assessment gives higher scores to wetlands with the capability to store or delay the downslope movement of surface water (e.g., wetlands that do not have surface water outlets).
In general, many of the wetlands in the study area have lower normalized function rating for the hydrological group of functions based on the WESP-AC functional assessment conducted in 2022. Many of the wetlands within the study area have both through-flowing watercourses and shallow soils that tend to function lower for water storage.

Wetland 15 was the only wetland within the assessment area with a moderate rating, the remaining wetlands were given a lower rating. Although the functional ratings were lower for hydrologic grouped functions, seven of the wetlands received a higher benefits rating.

5.3.2 Water Quality Support Group

The water quality support group is defined as a wetland's contribution to the quality of surface and groundwater of an area. This group considers the following four functions:

- Sediment retention and stabilization;
- Phosphorus retention;
- Nitrate removal; and
- Carbon sequestration.

Similar to the hydrologic group, wetlands with higher function scores typically do not have a surface water outlet and instead are isolated from flowing surface water. The normalized function rating for the water quality support group of functions was moderate for 14 out of the 15 wetlands based on the WESP-AC functional assessment conducted in 2022 for wetlands within the study area. Although the functional ratings were lower or moderate for this group of functions, the average benefits rating for these functions was often considered "higher".

5.3.3 Aquatic Support Group

The aquatic support function of a wetland determines a wetland's ability to support ecological stream functions that promote habitat health. This group considers the following four functions:

- Stream flow support;
- Aquatic invertebrate habitat;
- Organic nutrient export; and
- Water cooling.

The normalized function rating for the aquatic support group functions was high for 13 out of the 15 wetlands based on the WESP-AC functional assessment conducted in 2022 for wetlands within the study area. Wetlands lying adjacent to or containing flowing water and headwater wetlands typically score the highest in this group. As discussed above, all of the wetlands assessed in the Study Area had an outlet, many of which were formed around through flowing watercourses. As a result of these, wetlands in the vicinity of the PDA are considered to function highly for aquatic support. Six wetlands (Wetlands 3, 4, 6, 7, 11 and 12) had both "higher" function and benefit scores, noting that only three of these wetlands have areas that extend into and may be impacted within the PDA.

5.3.4 Aquatic Habitat Group

The aquatic habitat group considers the following five different functions:

- anadromous fish habitat;
- resident fish habitat;
- amphibian and turtle habitat;
- waterbird feeding habitat; and
- waterbird nesting habitat.

Wetlands with the highest functions within this group include those that are adjacent to or contain flowing water, including many of the assessed wetlands within the study area. The normalized function and benefit ratings for the aquatic habitat group of functions were both moderate for nine of the wetlands and high for six of the assessed wetlands based on the WESP-AC functional assessment conducted in 2022 for wetlands within the study area.

5.3.5 Transition Habitat Group

The main function of the collective group is to evaluate the wetland's ability to support healthy habitat for birds, mammals, and native plants. The transition habitat group comprises three different functions:

- songbird, raptor, and mammal habitat;
- native plant habitat; and
- pollinator habitat.

The average normalized function rating for the transition habitat group of functions was high (7.6) based on the WESP-AC functional assessment conducted in 2022 for wetlands within the study area. The benefits provided by the wetlands within the study area were ranked "moderate" (i.e., the average normalized ranking was 7.0). Wetland 7 had both a "higher" function and benefit score with individual function scores of higher for pollinator, as well as songbird, raptor, and mammal habitats (i.e., 8.8 and 8.3, respectively) and a moderate functional score for native plant habitat (i.e., 4.3). The benefit score for all three functions in this group was high for this wetland (i.e., 10 for each function). The higher scores for this functional group at WL7 take into consideration the presence of several species and risk and species of conservation concern that were identified near this wetland throughout the biophysical surveys conducted in 2021 and 2022 with associations with Gleason Brook that flows through WL7:

- Critical habitat for the Inner Bay of Fundy population of Atlantic Salmon (*Salmo salar* pop. 1);
- Brook trout (*Salvelinus fontinalis*) minnows observed in July 2022 within Gleason Brook;

- Eastern waterfan (*Peltigera hydrothyria*) observed in 2021 within Gleason Brook; and
- Large Purple Fringed Orchid (*Platanthera grandiflora*).

5.4 Wetlands of Special Significance

Wetlands within the study area were evaluated for their potential for meeting the criteria of a Wetlands of Special Significance (WSS). The wetlands were evaluated for the potential of being WSS in addition to functional assessment using the WESP-AC. Although the excel model used for the WESP-AS assessments includes an interpretation tool to classify WSS based on wetland functionality, it is recognized that the tool currently does not consider all aspects of WSS that are considered under the provincial Wetland Conservation Policy. The results of the WESP-AC WSS interpretation tool are included in Appendix B with the WESP-AC functional assessment summary for wetlands within the study area. None of the wetlands within the study area were flagged as WSS by the interpretation tool based solely on the functions assessment in 2022.

The Proponent understands that alterations to wetlands classified as WSS are generally not supported by NSECC unless work is being completed as a Necessary Public Function or to maintain, restore, or enhance the wetland, as defined within the Nova Scotia Wetland Conservation Policy (NSECC 2019). Five wetlands associated with Gleason Brook were identified within the study area as potential WSS (i.e., Wetlands 3, 4, 6, 7 and 12). After completing surveys for delineation/functional assessments, only three of the five potential WSS wetlands extend within the PDA (i.e., Wetlands 3, 6 and 7). Additional WESP-AC data for these wetlands will be provided to regulatory and permitting authorities prior to construction for further consultation and consideration if the potential WSS is not avoided. These three wetlands and the rationale for their potential to be WSS is provided below in Table 6 with a summary of the adjacent development within the PDA, if applicable.

Table 6: Potential WSS Rationale and Proposed Alterations within the PDA

Wetland ID	Rationale as a Potential WSS	Potential Alterations or Effects of the PDA
Wetland 3	Wetland has the potential to provide high hydrologic value. Function and benefits ratings of “Higher” for the Aquatic Support group of functions. Wetland is located upstream and hydrologically connected to a watercourses that is known to support SAR (eastern waterfan, IBoF population of Atlantic Salmon, brook trout).	The edge of this wetland is located adjacent to a proposed access road. The final design of this across road should consider avoidance of this wetland. This wetland is located within the PDA near T2. With careful site planning, the crane pad and footprint of T2 will avoid this wetland.

Wetland ID	Rationale as a Potential WSS	Potential Alterations or Effects of the PDA
		An overhead collector line is proposed to run across the eastern lobe of this wetland. With careful site planning, the transmission poles can be located outside the buffer and the line can span this wetland.
Wetland 6	Wetland has the potential to provide high hydrologic value. Function and benefits ratings of "Higher" for the Aquatic Support group of functions. Wetland has the potential to support high wildlife biodiversity. Function and benefits ratings of "Higher" for the Transition Habitat group of functions. Wetlands known to support SAR (eastern waterfan, Inner Bay of Fundy (IBoF) population of Atlantic Salmon, brook trout).	An existing access road that spans this wetland will be used as an access road for the Project. The final design should consider if the existing road requires upgrades. If so, upgrades should be considered that avoid altering, maintaining, restoring, or enhancing the potential WSS.
Wetland 7	Wetland has the potential to provide high hydrologic value. Function and benefits ratings of "Higher" for the Aquatic Support group of functions.	An existing access road that spans the eastern lobe of this wetland that will be used as an access road for the Project. The final design should consider if the existing road requires upgrades. If so, upgrades should be considered that avoid altering, maintaining, restoring, or enhancing the potential WSS.

As previously mentioned, five wetlands were identified within the study area as potential WSS, of these, three are located outside of the PDA and are not anticipated to be impacted by the proposed Project activities. Following the finalization of the Project layout, which will avoid the remaining three WSS to extent feasible, consultation with NSECC and NSDNR will be requested for confirmation of WSS status and permitting requests.

5.5 Assessment Conclusions

The biophysical environmental assessment of the proposed wind energy Project, the Westchester Wind Project, included the assessment of wetlands within the Study Are of a Project layout, including the associated infrastructure and 28 potential WTGs locations, noting that only up to 12 WTGs are expected to be developed. The final 12 WTG are expected to produce up to 50 MW of renewable energy, which will be connected to the existing Nova Scotia Power transmission grid via an overhead transmission line. The Project is located on a mixture of privately owned blueberry fields, previously forested land, and undeveloped forested land in Cumberland County near Westchester Station, Rose, and Londonderry communities.

As previously discussed, the Project layout was designed to attempt to minimize interactions with wetlands. WTGs will not be located within 30 m of a wetland, and depending on the final road and collector network selected for development, up to 15 wetlands were identified that have extent within 30 m of the PDA. These wetlands included treed and shrub swamps with lesser areas of fens and wet meadows. During the 2021 and 2022 field assessments, 11 of these wetlands were found to extend into the PDA with <2 ha of wetland area within the PDA. Further, of the wetlands that extend within the PDA, the use of mitigation measures and careful selection of which locations are included in the final design will further reduce the area of wetlands with the potential to be impacted.

The WESP-AC wetland analysis indicated that, on average, wetlands within the study area have highest rankings for functions related to aquatic support (i.e., stream flow support, aquatic invertebrate habitat and organic nutrient export and water cooling functions) and as transition habitats (i.e., songbird, raptor, and mammal habitat; native plant habitat; and pollinator habitat functions). Wetlands within the study area have lower ratings for functions related to water quality support (i.e., Sediment retention and stabilization, phosphorus retention; nitrate removal; and carbon sequestration).

Wetlands within the study area were evaluated for their potential for meeting the criteria of a WSS as defined within Nova Scotia's Wetland Conservation Policy (NSECC 2019). Six wetlands were identified within the study area as potential WSS, of these, three are located outside of the PDA and are not anticipated to be impacted by the proposed Project activities. Consultation with NSECC and NSDNR will be requested for confirmation of potential WSS status and permitting requests prior, the project layout will avoid the three potential WSS to extent feasible.

6.0 Effects Assessment and Mitigation Recommendations

6.1 Identification of Project Interactions

Wetlands were assessed as a biophysical VEC because they perform many important ecological, social, and economic functions and services in landscapes (NSE 2019).

In addition to performing many ecologically important landscape functions, wetland ecosystems are typically some of the most productive ecosystems encountered in Nova Scotia (NSECC 2019). As such, in Nova Scotia (and elsewhere), many other VECs (e.g., SAR and SoCC, migratory birds and culturally significant flora and fauna) are hosted within wetland ecosystems. Loss or degradation of wetlands results in a loss or decrease in their ability to perform their ecosystem services and functions and a reduction in biodiversity (NSE 2019).

6.1.1 Approach to Project Components

The Project has three main distinct phases during each of which the potential interactions with the surrounding environment are considered distinct. Unplanned events are considered separately from the phases. The phases of the Project include:

1. Planning, Site Preparation, and Construction;
2. Operation; and
3. Decommissioning.

The Project interaction matrix in Table 7 is used as an initial screening to assist in determining if an interaction is possible between the activities being carried out in each phase of the Project and wetlands.

Table 7: Project Interactions with Environmental Components

Valued Environmental Component	Project Phases			
	Planning, Site Preparation and Construction Phase	Operation Phase	Decommissioning Phase	Unplanned Events
Wetlands	✓		✓	✓

Legend: ✓ = Potential interaction identified

Those Project phases for which a checkmark is provided indicates that the Project may interact with wetlands, and thus an environmental effects assessment is warranted. In this case, it is possible that interactions could occur during the Planning, Site Preparation, and Construction Phase and the Decommissioning Phase, as well as unplanned events (including but not limited to accidents, malfunctions, and severe weather events), which are all discussed below.

6.1.2 Identification of Potential Environmental Effects

The proposed WTG locations and transmission/collector line poles are not predicted to directly interact with identified wetlands as none were delineated within the proposed footprint of these structures. As currently designed, the PDA has crossings of wetlands with linear infrastructure for access roads and collector lines. The access road and collector network utilize the existing access road network that is in place for current site operations and many of the crossing have existing culverts that will be maintained, negating the need for working within the watercourses; however, potential alterations (e.g., infilling) may be required for wetlands within the final layout of the Project.

In order to mitigate risk to wetlands, WTGs will be set back at least 30 m from wetlands. During construction of the collector network, care will be taken to avoid wetlands as much as feasible, and all attempts will be made to span watercourses with poles. Best management practices for erosion and sediment control will be implemented to monitor potential impacts to wetlands. If wetland areas or function are affected, the Project will also adhere to the Nova Scotia Wetland Conservation Policy Mitigation Sequence to prevent the net loss of wetland area and function (NSE 2019). As described in the Nova Scotia Wetland Conservation Policy, monitoring and an adaptive approach are essential for the following three sequence stages to ensure net loss is prevented:

a) Avoidance of adverse effects;
b) Minimization of unavoidable adverse effects; and
c) Compensation for adverse effects that cannot be avoided (NSE 2019).

The goals of this policy are taken in to account in the continuous planning of the Project in conjunction with all other site considerations. Further consultation and discussions with NSECC and NSDNRR will be requested for assessment of WSS status, permitting requests, and compensation measures.

Although direct impacts to wetlands are minimized as much as feasible in the siting phase, some minor infilling will likely be required for certain wetlands adjacent to existing access roads. A change in wetland size and/or function could occur during the construction of access roads or site restoration in the areas of the wetlands that may require clearing. This could alter the vegetation, increase erosion rates or alter natural drainage patterns in proximity to the aquatic receptors and/or alter the functions of a wetland. Loss of wetland area or function (i.e., hydrological regime, habitat and water quality maintenance) could occur due to the clearing of trees and vegetation within the wetlands.

Information gathered on wetlands within the Wetland LAA during the preliminary wetland assessment is outlined in Section 5.1. During the 2021 and 2022 field assessments within the Study Area, 15 wetlands (with approximately 1.6 ha of wetland land within the PDA) were assessed. These wetlands included treed and shrub swamps with lesser areas of bogs, fens, and wet meadows.

6.1.3 Standard Mitigation of Potential Environmental Effects

Standard mitigation has been identified for the anticipated interaction and/or effect in relation to wetlands in an attempt to prevent the interaction from occurring if possible, or to reduce the magnitude, geographic extent, frequency, duration, reversibility, or ecological/socioeconomic context of the interaction. Best management practices (based on industry guidelines and regulatory guidance documents) have been proposed as mitigation measures. In addition, several acts, codes, regulations, and guidelines may require appropriate actions to be conducted as mitigation measures prior to or during the interaction.

The federal and provincial legislation and codes that could apply to the Project include (but may not be limited to):

- *Canadian Environmental Protection Act* and regulations (ECC 1999);
- *Species at Risk Act* (ECCC 2002);
- *Transportation of Dangerous Goods Act*, and regulations (TC 1992);
- Nova Scotia *Environment Act* and regulations (NSECC 1994-95);
- Nova Scotia Water Resources Protection Act, and regulations (NSECC 2000);
- Nova Scotia Endangered Species Act, and regulations (NSECC 1998a);
- Nova Scotia Wilderness Areas Protection Act, and regulations (NSECC 1998b); and
- Contingency Planning Guidelines (NSECC 2021).

To further reduce the likelihood of interactions between any phases of the Project wetlands, the mitigation measures, summarized below in Table 8 will be followed.

Table 8: Potential Interactions and Proposed Mitigation for Wetlands

Potential Interactions with Wetlands	Proposed Mitigation Measures
During the construction phase, Project activities, such as clearing, grubbing, infilling, and excavation, have the potential to impact wetlands. Such activities have the potential to induce silt run-off, alter flow into the wetlands or see them become repositories of significantly increased water flow, nutrients or sediments. Total loss of wetlands or a portion of wetlands within the footprint of new roads and infrastructure which may impact the	1. Avoiding work within 30 m of wetlands to the extent feasible; 2. Where avoidance is not possible, disturbances will be minimized as much as feasible (i.e., limited to the area which is required to accomplish the Project objectives); 3. A wetland alteration approval will be applied for and obtained for work in any wetland, noting that work within wetlands will be avoided or minimized to the extent possible during the Project design phase;

Potential Interactions with Wetlands	Proposed Mitigation Measures
interconnectivity of adjacent wetlands within the same watershed.	4. Wetlands will be visually delineated (i.e., flagged) and all workers on site will be familiarized with impact-minimizing activities around them; 5. Appropriate sediment erosion and run-off control measures (e.g. silt fencing, hay bales) will be implemented following best management practices; 6. Natural regeneration of the site will be promoted to aid in storm water retention and reduce run-off; and 7. Compensation for net loss of wetland function; and, 8. Proper wetland protection and erosion and sediment control measures following the Environmental Management and Protection Plan (Appendix O) will be installed and checked regularly during the construction phase and prior to, and after, storm events to ensure they are continuing to operate properly to minimize potential effects to adjacent habitat. Mitigation Measures for Unplanned Events 1. Chemicals and petroleum products will be managed in accordance to manufacturer specifications and stored more than 30 m from a watercourse or wetland; 2. No stockpiling of materials will occur within 30 m of a wetland; 3. Vehicle traffic in the wetlands will be minimized by using alternate techniques (e.g. hand cutting vegetation) where possible; 4. Equipment shall be kept in good working order and maintained so as to reduce risk of spills/leaks and to avoid water contamination; 5. Mats and other means to avoid disruption of the wetlands will be used during necessary tree clearing; 6. Wetlands within the PDA of collector or transmission lines will be spanned with electrical poles where possible where feasible;

Potential Interactions with Wetlands	Proposed Mitigation Measures
	7. No refueling of equipment will occur within 30 m of a wetland; 8. Frequent inspection of equipment will ensure fluids do not leak into wetlands; 9. Spill response kits must be readily available for each piece of equipment, on site workers are required be knowledgeable on emergency spill response protocols and initiate corrective measures immediately to minimise any impacts to the surrounding environment; 10. Refueling, oiling, and maintenance of equipment will be completed in specifically designated areas located at least 30 m away from any watercourse, wetland, or well to minimize potential effects that could arise in the event of a spill; 11. If contaminated soil is encountered, it will be reported to NSE and managed utilizing the Nova Scotia Contaminated Site Regulations; and, 12. Avoid work during storm events.

Throughout the wetland alteration permitting process, a post-construction monitoring program and compensation plan for wetlands will be developed in consultation with Nova Scotia Department of Natural Resources and Renewables (NSDNRR) and implemented following approval.

6.2 Residual Environmental Effects

A residual environmental effect is an environmental effect of a project that remains, or is predicted to remain, after mitigation measures have been implemented (GOC 2022). The Project will be developed in such a way as to avoid wetlands, minimize disturbance to wetlands where avoidance is not possible, and minimize the area of disturbance within the Project site. Avoidance through site design has been completed to the extent possible (i.e., avoiding wetlands where possible, spanning wetlands using overhead collection lines, and use of existing roads). In addition, following the construction and decommissioning phases of the Project, natural revegetation with native species will be promoted in consultation with the landowners to minimize the potential for habitat loss and invasive species spread. Given current knowledge as informed by the desktop assessment, biophysical assessments, and previous site activities, significant potential impacts to wetlands are not anticipated as a direct result of the Project with the appropriate implementation of the mitigation measures presented and with wetland compensation for unavoidable net loss of wetland function.

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In consideration of the above and planned mitigation, the residual environmental effects of the Project on wetlands during all phases including unplanned events are anticipated to be significant.

6.3 Cumulative Environmental Effects

Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions (GoC 2022). Specific to the nature of the undertaking, cumulative effects are combined impacts that may occur when wind power projects or other types of projects are located in the same region (NSECC 2021).

As discussed above, a portion of the PDA is located within privately-owned lands that are used for forestry and agriculture and has a network of existing access roads and trails. The WESP-AC functional assessment considered existing stressors on the assessed wetlands. Existing stressors affect the degree to which the wetland is or has recently been altered by, or exposed to risk from, human-related factors that degrade its ecological condition and/or reduce its capacity to perform one or more of the functions listed in this document (Adamus 2018). Without mitigation measures, cumulative effects to wetlands could occur as a result of:

- Contributing to a change in the aberrant timing of water inputs through the addition road fill within or downgradient from the wetland that interferes with surface or subsurface flow in/out of the wetlands or the ditching of tributary channels. Contributing sediment loading from the contributing area caused by erosion from timber harvest, dirt roads and vegetation clearing; and
- Contributing to existing soil or sediment alteration within the wetland by building or modifying access roads that are not graded to the natural contour.

The above mitigation measures minimize contributions to cumulative effects through the minimization of impacts to undisturbed habitats, and effective mitigation measures to manage further impacts to wetlands and biophysical VECs that rely on them as habitat. The above mitigation measures were carefully developed to prevent residual impacts to wetlands as a result of the Project. Therefore, in consideration of the above and planned mitigation, the residual cumulative environmental effects of the Project in combination with past, present, or reasonably foreseeable projects or activities on wetlands during the phases including unplanned events are not anticipated to be significant.

7.0 Summary and Conclusion

The information provided in this document is based on the currently available design/planning information and existing environment information obtained during focused field surveys conducted throughout 2021 and 2022. As previously discussed, the Project layout was designed to attempt to minimize interactions with wetlands. Care will be taken to avoid wetlands, and all attempts will be made to span wetlands with poles; however, pursuant to the Nova Scotia Wetland Conservation Policy, for any Projects that negatively affect wetland areas or function, NSECC will require the adherence to the mitigation sequence to prevent the net loss of wetland area and function (NSE 2019).

NSECC's mitigation sequence is a hierarchical progression of alternatives laid out to achieve wetland conservation. As described in the Nova Scotia Wetland Conservation Policy, monitoring and an adaptive approach are essential for the following three sequence stages to ensure net loss is prevented:

- *Avoidance* of adverse effects;
- *Minimization* of unavoidable adverse effects; and
- *Compensation* for adverse effects that cannot be avoided (NSE 2019).

The goals of this policy are taken into account in the continuous planning of the Project in conjunction with all other site considerations.

This report has been prepared for the Environmental Assessment of the Westchester Wind Project. The Project is expected to provide renewable electricity to Nova Scotia and support Nova Scotia Power in attaining their future renewable energy targets.

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8.0 Closure

This report was prepared by Dillon Consulting Limited (Dillon) for Natural Forces Developments Limited Partnership (the Proponent) on behalf of the Westchester Wind Limited Partnership, in support of the Westchester Wind Project Addendum (2022). Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

9.0 References

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Appendix A

Wetland Factsheets

Wetland 1 – Treed Swamp

Delineated total area: 0.03 ha.

Approximate area within PDA: 0 ha (0%)

Delineated: 14 July 2021

Hydrological Features: Standing was in stream (~ 5 cm), saturated soils, high water table (~12 cm below surface), water-stained leaves, aquatic fauna, drainage patters and drift deposits and moss trimline.

Vegetation Profile

Stratum	Plant Species
Tree	Yellow Birch (*Betula alleghaniensis*), Sugar Maple (*Acer saccharum*), *Picea spp.*
Sapling/Shrub	Hobblebush (*Viburnum lantanoides*), Yellow Birch (*Betula alleghaniensis*), *Picea spp.*
Herb	Nodding Sedge (*Carex gynandra*), *Glyceria melicaria,* Eastern Rough Sedge (*Carex scabrata*), Rough Bedstraw (*Galium asprellum*), Canada Bluejoint (*Calamagrostis canadensis*), Two-leaved Toothwort (*Cardamine diphylla*), Pennsylvania Bitter-cress (*Cadramine pensylvanica), Viola spp.*

Soil Profile of Wetland 1

Depth	Matrix	Redox Features	Texture
7-0”	n/a	n/a	Undecomposed organics
0-4”	2.5YR 2.5/1 (100%)	n/a	Sandy Silt
4”+	Restrictive Layer	n/a	Gravels/Bedrock

Wetland 2 – Wet Meadow/Swamp

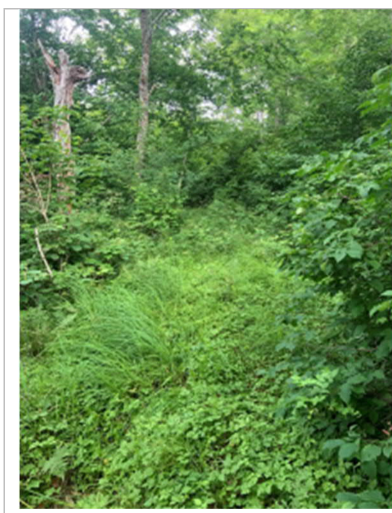
Delineated total area: 0.55 ha
Approximate area within PDA: 0.1 (18%)
Delineated: July 12, 2022
Hydrological Features: Surface water (up to 35 cm deep), saturated soils, aquatic fauna.

Vegetation Profile of Wetland 2

Stratum	Plant Species
Tree	Grey Birch (*Betula populifolia)*, *B. alleghenien*, Balsam Fir (*Abies balsamea)*, *Salix spp.,* Paper Birch (*Betula papyrifera)*, *Amelanchier spp.*
Sapling/Shrub	*Salix* spp., White Meadowsweet (*Spiraea alba*)
Herb	Sensitive Fern (*Onoclea sensibilis)*, Smaller Forget-me-not (*Myosotis laxa), Carex, Symphyotrichum puniceum*

Soil Profile of Wetland 2

Depth	Matrix	Redox Features	Texture
0-8"	7.5YR 3/2 (100%)	N/A	Clay loam
8+"	Restrictive layer	N/A	Gravel




WL-2 Ponded Water and Vegetation
(August 10, 2022)

2022 Vegetation Plot
(July 12, 2022)

Wetland 3 – Treed Swamp

Delineated area total area: 3.67 ha.
Approximate area within PDA: 0.28 ha (7.7%)
Delineated: July 19, 2021
Hydrology: Surface water (7-10 cm), saturated soils, drainage patterns, water table was found to be at or very near (2-5 cm below ground surface).

This wetland is subject to a number of ongoing anthropogenic influences as it is largely surrounded by managed blueberry fields and conifer plantations. The southern boundary of WL-3 is constrained by a dirt access road and portions of its northern boundary appear to have been historically cleared and planted with rows of conifers. The wetland has two inputs entering from the northwest and southwest, respectively, which merge within the wetland area and may represent the headwaters of Gleason Brook. The wetland outlets to the east as a permanent channel before flowing into WL-4.

Vegetation Profile of Wetland 3

Stratum	Plant Species
Tree	Black Spruce
Sapling/Shrub	Speckled Alder
Herb	Sensitive Fern, Canada Bluejoint, Rough-stemmed Goldenrod, Crested Shield Fern (*Dryopteris cristata*), Golden Groundsel (*Packera aurea*), Fowl Manna Grass, Tall Meadow-rue

Soil Profile of Wetland 3

Depth	Matrix	Redox Features	Texture
10-0”	n/a	n/a	Mucky organics
0”+	Restrictive Layer	n/a	Gravels

2022 Vegetation Profile of Wetland 3

Stratum	Plant Species
Tree	Black Spruce, American Mountain Ash (*Sorbus Americana*), Balsam Fir, Red Maple, Gray Birch (*Betula populifolia*), *Prunus spp.*
Sapling/Shrub	Balsam Fir, Gray birch, Speckled Alder, Black Spruce, American Mountain Ash, Red Maple, *Prunus spp.*
Herb	Sensitive Fern, Rough-stemmed Goldenrod, Crested Shield Fern (*Dryopteris cristata*), Fowl Manna Grass, Tall Meadow-rue, *Equisetum spp.,* Cinnamon Fern, Purple-stemmed Aster, Nodding Sedge, Dwarf Raspberry, Red Raspberry (*Rubus idaeus*), Smaller Forget-me-not (*Myosotis laxa),* Star Sedge, Creeping Buttercup (*Ranunculus repens*) *Ludwigia palustris*, *Lycopus spp.*,

2022 Soil Profile of Wetland 3

Depth	Matrix	Redox Features	Texture
1-0"	n/a	n/a	Duff, Decomposing organics
0-5"	7.5YR 2.5/1	n/a	Silty Loam
5-10"	7.5YR 2.5/1	n/a	Sandy Loam
10"+	Restrictive Layer	n/a	Sands and Gravels


Wetland 3 Plant Plot (July 19, 2021)


Photo of Wetland 3 (July 19, 2021)


Wetland 3 Plant Plot (July 12, 2022)


Wetland 3 (July 12, 2022)

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Wetland 4 –Tree and Shrub Swamp

Approximate/delineated total area: 4.06 ha
Approximate area within PDA: 0.00 ha (0.0%)
Delineated: July 19, 2022
Hydrological Features: The soil conditions in WL-4 were saturated, the water table was found to be at or very near the soil surface and there were occasional shallow ponded areas (1 to 2 inches) in addition to a larger ponded area (which was deeper, but could not be measured). Aquatic fauna was observed within the wetland.

This wetland has at least four inlets, including the permanent channelized inlet deriving from Wetland 3. As with WL-3, this wetland also appears to have had portions of its area historically cleared and planted with rows of conifers. A ponded area within WL-4 appears to be the result of an active beaver dam, which also restricts the outflow of the wetland.

Vegetation Profile of Wetland 4

Stratum	Plant Species
Tree	Black Spruce
Sapling/Shrub	Speckled Alder
Herb	Sensitive Fern, Canada Bluejoint, Rough-stemmed Goldenrod, Crested Shield Fern (*Dryopteris cristata*), Golden Groundsel (*Packera aurea*), Fowl Manna Grass, Tall Meadow-rue

Soil Profile of Wetland 4

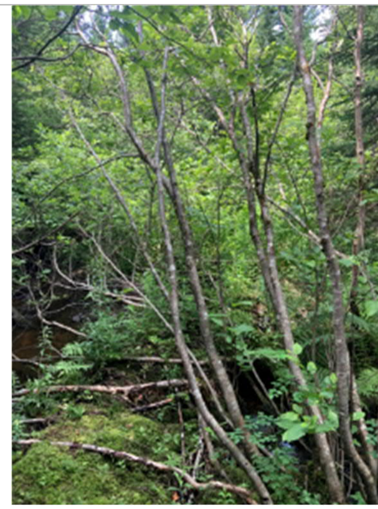
Depth	Matrix	Redox Features	Texture
10-0”	n/a	n/a	Mucky organics
0”+	Restrictive Layer	n/a	Gravels

2022 Vegetation Profile of Wetland 4

Stratum	Plant Species
Tree	Balsam Fir, Gray Birch, Black Spruce, *Picea spp.*
Sapling/Shrub	Speckled Alder, *Vibernum nudum,* Balsam Fir
Herb	Sensitive Fern, Three-seeded Sedge (*Carex trisperma),* Rough-stemmed Goldenrod, *Glyceria spp.*

2022 Soil Profile of Wetland 4

Depth	Matrix	Redox Features	Texture
0-20”	n/a	n/a	Hemic Histosol
20”+	Restrictive Layer		Coarse gravel

	
Wetland 4 (July 19, 2021)	
	
Beaver Dam (July 29, 2022)	Outlet of WL-4 via WC3b (July 29, 2022)

Wetland 5 – Treed Swamp

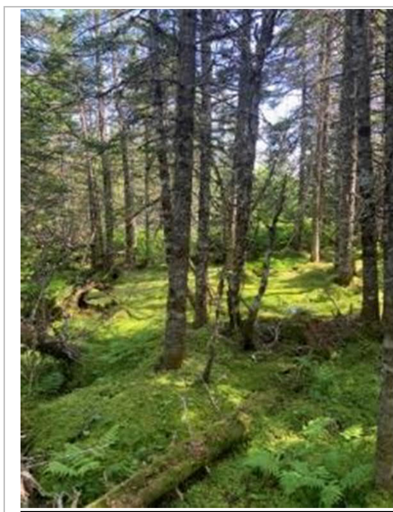
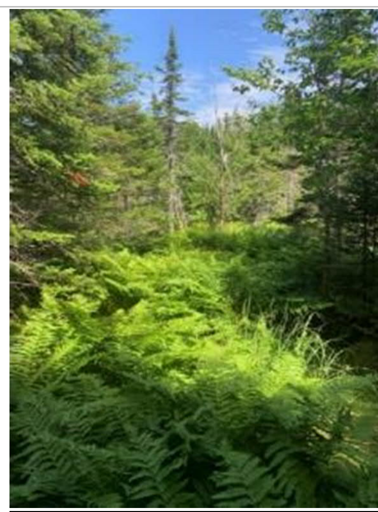
Delineated total area: 0.51 ha
Approximate area within PDA: 0.23 ha (45%)
Delineated Date: July 14, 2022
Hydrology: Surface water (stream: ~5-10cm), high water table, water-stained leaves, aquatic fauna, drainage patterns, sphagnum moss.

Vegetation Profile of Wetland 5

Stratum	Plant Species
Tree	Balsam Fir (*Abies balsamea)*, Black Spruce (*Picea mariana).*
Sapling/Shrub	Yellow Birch (*Betula alleghaniensis*), Balsam Fir (*Abies balsamea),* Black Spruce (*Picea mariana*).
Herb	Star Sedge (*Carex echinata*), Nodding Sedge (*Carex gynandra*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Rough-stemmed Goldenrod (*Solidago rugosa)*, *Equisetum*, Marsh Skullcap (*Scutellaria galericulata*), Sensitive Fern (*Onoclea sensibilis*), *Carex utriculata*, Swamp Candle (*Lysimachia terrestris*), Fringed Sedge (*Carex crinita*), *Carex stipata*, *Carex disperma*, *Persicaria sagittata*, Canada Manna Grass (*Glyceria canadensis*), *Hypericum spp., Anthoxanthum spp., Galium spp.*

Soil Profile of Wetland 5

Depth	Matrix	Redox Features	Texture
18-0”			Peat/Sphagnum
18”+	Restrictive Layer		Bedrock


Wetland 5 (July 14, 2021)

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Wetland 6 – Fen/Shrub Swamp

Delineated/predicted total area: 4.51 ha
Approximate area within PDA: 0.17 ha (3.8 %)
Delineated Date: July 15, 2021
Hydrology: Saturated soils, shallow, standing water, water table that was at or very near the soil surface. Other indicators of wetland hydrology included observed aquatic fauna, including the eggs and larvae of Amystoma sp. salamanders.

Wetland 6 is a fen/shrub swamp complex, located west and adjacent to the Westchester Road. WL-6 were once likely one contiguous wetland with a wetland to the north which has been separated by an access road. WL-6 has two inlets which travel through culverts, one flows under the access road/ATV trail and another flows under the Westchester Road from the east. A tributary towards Gleason Brook flows through WL-6 averages 35 cm deep, with pools up to 60 cm dee, noting that the channel is often incised through WL-6. Small brook trout in schools were observed in 2021 within this tributary. This second inlet is intermittent or ephemeral and appears to be the result of an old, overgrown ATV path.

Large Purple Fringed Orchids (Platanthera grandiflora) were found in this wetland, which is listed as S3 (vulnerable) according to the Atlantic Canada Conservation Data Centre (ACCDC).

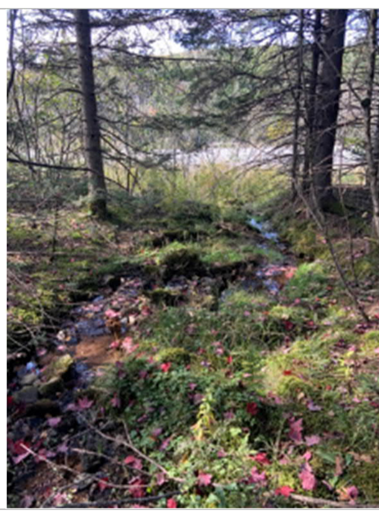
Vegetation Profile of Wetland 6 - 2021

Stratum	Plant Species
Tree	N/A
Sapling/Shrub	Speckled Alder
Herb	Canada Bluejoint, Swamp Yellow Loosestrife (*Lysimachia terrestris*), Marsh St. John’s Wort, Star Sedge, Small-fruited Bullrush (*Scirpus microcarpus*), Common Marsh Bedstraw, Large Purple Fringed Orchid

Soil Profile of Wetland 6 - 2022

Depth	Matrix	Redox Features	Texture
4-0”	n/a	n/a	duff layer/organics
0-12”	10YR 2/1 (100%)	none	Silt w/ organics
12”+	Restrictive Layer	n/a	Cobbles/gravels

	
	
Wetland 6 (July 15, 2021)	

	
Permanent and ephemeral channel within Wetland 6 (July 15, 2021)	

Wetland 7 – Fen

Delineated total area: 2.78 ha
Approximate area within PDA: 0.1 (4%)
Delineated: July 13, 2022
Hydrological Features: Water-stained leaved, saturation at surface, standing water (25 cm depth), aquatic fauna (minnows) and drainage patterns.

Vegetation Plot 1- 2022

Stratum	Plant Species
Tree	Black Spruce (*Picea mariana*), Red Maple (*Acer rubrum)*
Sapling/Shrub	Grey Alder (*Alnus incana*), Black Spruce (*Picea mariana*)
Herb	Tussock Sedge (*Carex stricta*), Canada Bluejoint (*Calamagrostis canadensis*)

Soil Profile 1 -2022

Depth	Matrix	Redox Features	Texture
0-1.0m	n/a	n/a	Humic
1.0m	Restrictive Layer	n/a	Bedrock

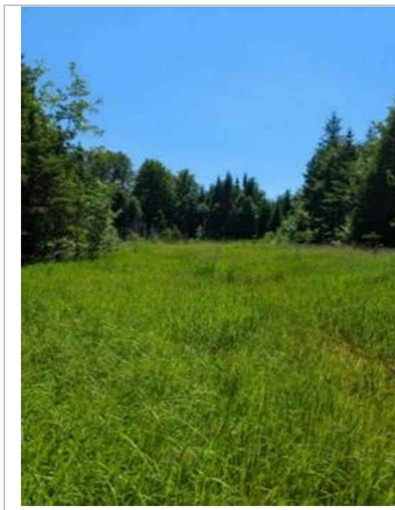

WL-7 Representative Photos of Soil/Vegetation Plot 1 (July 13, 2022)

Vegetation Plot 2 of WL-7

Stratum	Plant Species
Tree	Yellow Birch (*Betula alleghaniensis*), Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*), Grey Birch (*Betula populifolia*)
Sapling/Shrub	Balsam Fir (*Abies balsamea*), Grey Birch (*Betula populifolia*), *Salix* spp.
Herb	Cinnamon Fern (*Osmundastrum cinnamomeum*), Canada Bluejoint (*Calamagrostis canadensis*), Nodding Sedge (*Carex gynandra*), Rough-stemmed Goldenrod (*Solidago rugosa)*, Swamp Candle (*Lysimachia terrestris*), Canada Rush (*Juncus canadensis*), Rattlesnake Manna Grass (*Glyceria canadensis*), Star Sedge (*Carex echinata*), *Scirpus spp., Hypericum spp.*

Soil Profile 2 of WL-7

Depth	Matrix	Redox Features	Texture
0-20cm	n/a	n/a	Histosol – H&ML texture
20cm	Restrictive Layer	n/a	Rock



WL-7 Representative Photos of Soil/Vegetation Plot 2 (July 13, 2022)


Photos of Water Coarse through WL-7 outside of the PDA (July 14, 2022)

Wetland 8 – Hardwood Treed Swamp

Delineated total area: 0.1 ha.
Approximate area within PDA: 0.01 ha (1%)
Delineated: July 19, 2021
Hydrological Features: Saturated soils, drainage patterns, water-stained leaves, moss trimline, advantageous roots.

This wetland is surrounded by early succession deciduous regrowth as the surrounding upland appears to have been previously clear-cut. WL-8 drains toward and into WL-10, eventually joining Fountain Lake Brook approximately 500 m its outlet.

Vegetation Profile of Wetland 8 (July 2021)

Stratum	Plant Species
Tree	Yellow Birch, Red Maple, American Beech (*Fagus grandifolia*)
Sapling/Shrub	Mountain Maple, Balsam Fir, Speckled Alder
Herb	Interrupted Fern, Nodding Sedge, Canada Bluejoint, Necklace Sedge, Canada Manna Grass (*Glyceria canadensis*),

Soil Profile of Wetland 8 (July 2021)

Depth	Matrix	Redox Features	Texture
6-0”	n/a	n/a	Mucky organics
0”+	Restrictive Layer	n/a	Rock

Vegetation Profile of Wetland 8 (July 27, 2022)

Stratum	Plant Species
Tree	Yellow Birch, Red Maple
Sapling/Shrub	Yellow Birch, Mountain Maple, Balsam Fir, Red Maple, Speckled Alder, Redcurrant
Herb	Interrupted Fern, Nodding Sedge, Canada Manna Grass (*Glyceria canadensis*), Sensitive Fern, Purple-stemmed Aster (*Symphyotrichum puniceum*), Dwarf Raspberry, Pointed Broom Sedge, Creeping Dogwood, Starflower, Rattlesnake Mannagrass

Soil Profile of Wetland 8 (July 27, 2022)

Depth	Matrix	Redox Features	Texture
1-0”	n/a	n/a	Sphagnum/Duff/Organics
0-6”	7.5YR 2.5/1 (100%)	n/a	Clay Loam
6”+	Restrictive Layer	n/a	Cobbles/Boulders

		
Wetland 8 (July 19, 2021)		Wetland 8 Ephemeral Outlet (July 27, 2022)

Wetland 9 (a and b) – (Wet Meadow/Treed Swamp)

Delineated total area: 0.06 ha
Approximate area within PDA: 0.03 ha (50%)
Delineated: September 30, 2021
Hydrological Features: Saturated soil, standing water (approximately 2 to 4" in depth), drainage patterns, sparsely vegetated concave depressions, water-stained leaved and some limited surface soil cracking, moss trim lines, aquatic fauna (frogs and tadpoles) and drift deposits.

This small wetland is surrounded by early succession deciduous regrowth as the surrounding upland appears to have been previously clear cut. WL-9A/B does not appear to have any inlets and drains to the south into an unnamed tributary to Fountain Lake Brook.

Vegetation Profile of Wetland 9a - 2022

Stratum	Plant Species
Tree	Yellow Birch, Sugar Maple, White Ash (*Fraxinus Americana*)
Sapling/Shrub	Mountain Maple, Yellow Birch
Herb	*Glyceria melicaria*, *Lycopus spp.,* Dwarf Raspberry, Sensitive Fern, *Epilobium spp., Carex stipata,* Pointed Broom Sedge, Marsh Gladiolis (*Gladiolus palustris*), Star Sedge

Vegetation Profile of Wetland 9b - 2022

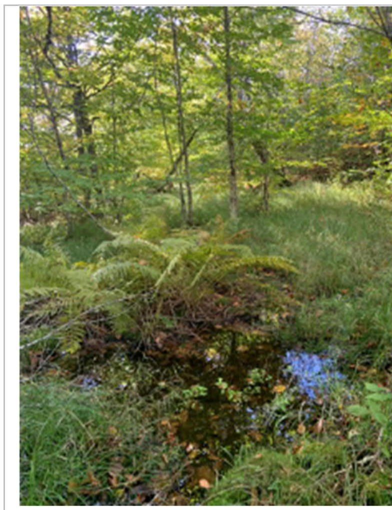
Stratum	Plant Species
Tree	Yellow Birch, Sugar Maple, Striped Maple (*Acer pensylvanicum)*
Sapling/Shrub	Yellow Birch, Mountain Maple, Beaked Hazelnut (*Corylus cornuta)*
Herb	*Glyceria melicaria*, Rough Bedstraw (*Galium asprellum*), *Lycopus spp.*¸ Eastern Rough Sedge (*Carex scabrata*)

Soil Profile of Wetland 9b

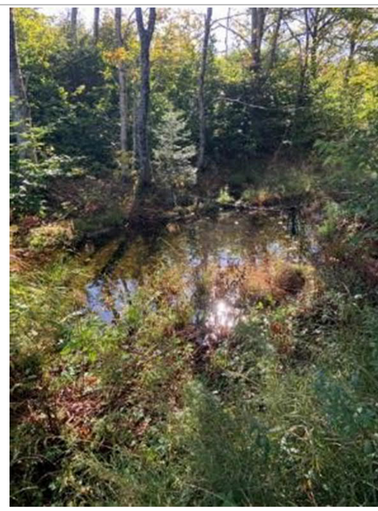
Depth	Matrix	Redox Features	Texture
5-0”	n/a	n/a	Undecomposed Organics
0-4”	2.5YR 2.5/1 (100%)	n/a	Silty
4”+	Restrictive Layer	n/a	Bedrock

Soil Profile of Wetland 9a

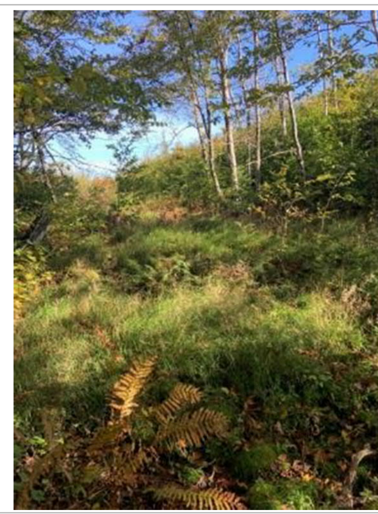
Depth	Matrix	Redox Features	Texture
6-0”	n/a	n/a	Under decomposed Organic Muck
0-5”	2.5YR 2.5/1 (100%)	n/a	Silty
5”+	Restrictive Layer	n/a	Bedrock



Wetland 9A
(September 30, 2021)

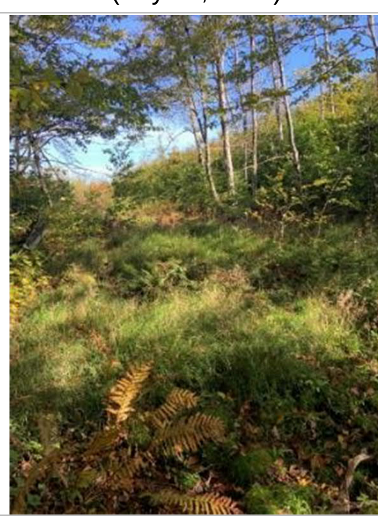


Wetland 9a
(July 14, 2022)

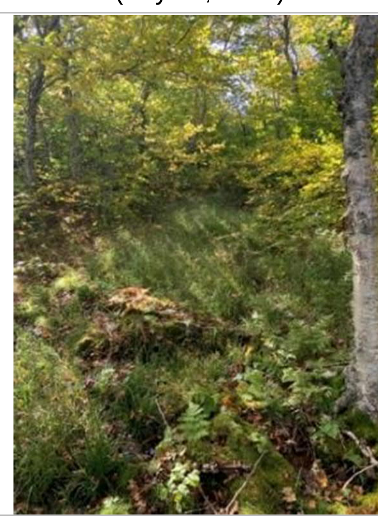


Wetland 9a
(July 14, 2022)

Wetland 9a
(July 14, 2022)



Wetland 9b 2022
(July 14, 2022)



Wetland 9b
(July 14, 2022)

Wetland 10 – Treed Swamp

Delineated total area: 0.89 ha.
Approximate area within PDA: 0.17 ha (19%)
Delineated: July 19, 2021
Hydrological Features: Saturated soil, 2-5 cm of standing water, high water table, aquatic fauna, drainage patterns, drift deposits, moss trimline, water-stained leaves, saturated soils, sparsely-vegetated concave surfaces, soil surface cracks and a channel (ephemeral).

This wetland is surrounded by early succession deciduous regrowth as the surrounding upland appears to have been previously clear-cut. The wetland has two ephemeral inlets along its northern edge and one outlet into an unnamed tributary to Fountain Lake Brook, which it joins a short 200 m further downstream, within an NSDNR mapped wetland located immediately northeast of T14.

Vegetation Profile of Wetland 10 (July 19, 2021)

Stratum	Plant Species
Tree	Yellow Birch, Red Maple
Sapling/Shrub	Speckled Alder, Balsam Fir, Yellow Birch
Herb	Canada Bluejoint, Sensitive Fern, White Turtlehead, Tall Meadow-rue, Northeastern Manna Grass, Yellow Avens (*Geum aleppicum*), Jack in-the-pulpit

Soil Profile of Wetland 10 (July 19, 2021)

Depth	Matrix	Redox Features	Texture
10-0”	n/a	n/a	Mucky, dark organics
0”+	Restrictive Layer	n/a	Possibly bedrock, cobbles

Vegetation Profile of Wetland 10 (July 28, 2022)

Stratum	Plant Species
Tree	Yellow Birch, Red Maple
Sapling/Shrub	Sugar Maple, Speckled Alder, Balsam Fir, Yellow Birch, Mountain Maple, Striped Maple, Redcurrant (*Ribes rubrum*)
Herb	Canada Bluejoint, Sensitive Fern, White Turtlehead, Northeastern Manna Grass, Jack in-the-pulpit, Dwarf Raspberry, Necklace Sedge (*Carex projecta*), *Glyceria striata, Geum spp., Galium spp., Epilobium spp.*

2022 Soil Profile of Wetland 10 (July 28, 2022)

Depth	Matrix	Redox Features	Texture
0-5”	7.5 YR 2.5/1 (100%)	n/a	Organic muck with silt
5”+	Restrictive Layer Clayey	n/a	Gravels

		
Wetland 10 (July 19, 2021)		Wetland 10 Outflow Channel (July 28, 2022)

Wetland 11 – Fen/Shrub Swamp

Delineated total area: 2.5 ha
Approximate area within PDA: 0.14 ha (6%)
Delineated: July 19, 2021
Hydrological Features: Saturated soil, water table was at or near, aquatic fauna (minnows), drift deposits and water-stained leaves, sphagnum moss, drainage patterns, standing water and mucky depressions.

Wetland 11 (WL-11) is located southeast of the proposed location of T5. Forest harvesting has taken place in the surrounding upland area of WL-11 and a wide, trench appears to collect road drainage, directs flow towards the wetland area. There is no channelized stream within the northern lobe of this wetland (area within the PDA); however, subterranean flow was visible in pockets of open water. This northern lobe of WL-11 drains to the east, becoming narrower, and eventually channelizes into a stream that is conveyed by a small culvert under an old ATV trail into a second, larger lobe. This second, more southern, lobe features a permanent ponded area, which likely holds small minnow species. The ponded area appears to be the result of an active beaver dam, which restricts the outflow of WL-11 into an adjacent but separate wetland.

2021 Vegetation Profile of Wetland 11

Stratum	Plant Species
Tree	Black Spruce, Balsam Fir, Yellow Birch
Sapling/Shrub	Black Spruce, Balsam Fir, Yellow Birch, Willows
Herb	Nodding Sedge, Canada Bluejoint, Atlantic Sedge, Cinnamon Fern

2021 Soil Profile of Wetland 11

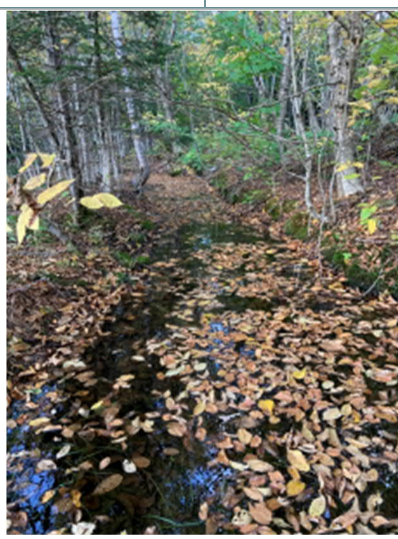
Depth	Matrix	Redox Features	Texture
12-0"	n/a	n/a	Organic (100% Sphagnum)
0"+	Restrictive Layer	n/a	Possibly bedrock

2022 Vegetation Profile of Wetland 11

Stratum	Plant Species
Tree	Black Spruce
Sapling/Shrub	Black Spruce, Red Maple, Balsam Fir, Yellow Birch, Grey Alder, Labrador Tea
Herb	Nodding Sedge, Cinnamon Fern, Star Sedge, Canada Manna Grass (*Glyceria canadensis*), Dwarf Raspberry, Woolgrass, Dark-green Bullrush, *Persicaria sagittata*, Rough-stemmed Goldenrod, Soft Rush (*Juncus effusus*), Starflower (*Trientalis borealis*), Creeping dogwood (*Cornus canadensis*)

2022 Soil Profile of Wetland 11

Depth	Matrix	Redox Features	Texture
11-0"	n/a	n/a	Organic (100% Sphagnum)
0"+	Restrictive Layer	n/a	Bedrock



Trench Draining into Northern Lobe of Wetland 11 (left), Inlet of Wetland 11 (right) (October 8, 2021)

	
Southern Lobe of Wetland 11 and culvert at the outlet (July 19, 2021)	
	
Northern Lobe of Wetland-11 and Representative Vegetation (July 19 and October 8, 2021)	

Wetland 12 – Shrub Swamp

Delineated total area: 1.78 ha
Approximate area within PDA: 0 ha (0%)
Delineated: July 19, 2021 and July 14, 2022
Hydrological Features: High water table, water-stained leaves, drainage patterns, aquatic fauna, drift and sediment deposits, and saturated soils.

Wetland 12 is located adjacent to the west of Westchester Road, where it functions as a floodplain area for Gleason Brook. An existing timber-decked bridge structure spans Gleason Brook at this wetland's outlet and a large culvert conveys the brook southward. The wetland is largely surrounded by managed blueberry fields on all sides, and as such, has had much of its forested buffer has been cleared.

2021 Vegetation Profile of Wetland 12

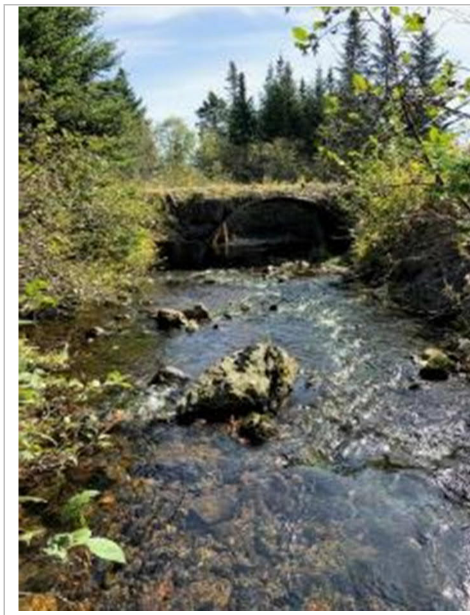
Stratum	Plant Species
Tree	N/A
Sapling/Shrub	Speckled Alder, Meadowsweet (*Spirea alba*)
Herb	Canada Bluejoint, American Bur-reed (*Sparganium americanum*), Sensitive Fern, Common Marsh Bedstraw, Tall-Meadow-rue, Wild Mint

2022 Vegetation Profile of Wetland 12

Stratum	Plant Species
Tree	N/A
Sapling/Shrub	Speckled Alder (*Alnus incana*)
Herb	Canada Bluejoint, American Bur-reed (*Sparganium americanum*), Sensitive Fern, Common Marsh Bedstraw, Tall-Meadow-rue (*Thalictrum pubescens*), *Glyceria striata*, Nodding Sedge, Shallow Sedge (*Carex lurida*), *Euthamia graminifolia*, Rough-stemmed Goldenrod (*Solidago rugosa*), Swamp Candle (*Lysimachia terrestris*), Star Sedge (*Carex echinata*), Woolgrass (*Scirpus cyperinus*), *Scirpus microcarpus*, Dark-green Bulrush (*Scirpus atrovirens*), *Carex stipata*, Rattlesnake Mannagrass (*Glyceria canadensis*), Canada Rush (*Juncus canadensis*), Marsh Gladiolus (*Gladiolus palustris*), Orange jewelweed (*Impatiens capensis*), *Persicaria sagittata*, *Arisaema triphyllum*, *Hypericum spp.*

Soil Profile of Wetland 12 - 2022

Depth	Matrix	Redox Features	Texture
6-0”	n/a	n/a	Decomposing Organics
0-4”	2.5YR 2.5/1	n/a	Silty
4-12”	10YR 4/1 (90%)	5YR 5/4 (10%)	Sand
12”+	Restrictive Layer	n/a	Gravels

	
Large Culvert at the Outlet (July 19, 2021)	Wetland 12 (July 19, 2021)

Wetland 12 (July 19, 2021)

Wetland 13 – Treed Swamp

Delineated total area: 0.03 ha.
Approximate area within PDA: 0 ha.
Delineated: July 14, 2021
Hydrological Features: This wetland has an inlet and outlet with an intermittent channel meandering through the wetland area. WL-13 drains to the southeast via an unnamed tributary to Fountain Lake Brook. The soil conditions in WL-13 were saturated and the water table was approximately 8” below the surface. Other indicators of wetland hydrology included water-stained leaves, drift deposits and drainage patterns.

Vegetation Profile of Wetland 13

Stratum	Plant Species
Tree	yellow birch (*Betula allegheniensis*), sugar maple (*Acer saccharum*)
Sapling/Shrub	mountain maple (*Acer spicatum*), sugar maple, yellow birch, hobblebush (*Viburnum lantinoides*), Common blackberry (*Rubus allegheniensis*)
Herb	northeastern manna grass (*Glyderia melicaria*), nodding Sedge (*Carex gynandra*), Star Sedge (*Carex echinata*), Pointed Broom Sedge (*Carex scoparia*), Wood Fern (*Dryopteris spp.*), Dwarf Raspberry (*Rubus pubescens*)

Soil Profile of Wetland 13

Depth	Matrix	Redox Features	Texture
2-0”	n/a	n/a	duff layer
0-10”	2.5Y 2.5/1 (100%)	none	Silty loam mixed w/ dark organics
10”+	Restrictive Layer	n/a	Cobbles/gravels

Wetland 14 – Treed Swamp

Delineated total area: 0.72 ha.
Approximate area within PDA: 0.23 ha (32%)
Delineated: July 14, 2021
Hydrological Features: Drainage patterns, water-stained leaves, saturated soils, high water table and a sulfur odour.

Wetland 14 is s a treed swamp and is located between the proposed locations of T7 and T13. This wetland has an inlet and outlet with an intermittent channel meandering through the wetland area connecting them. WL-14 drains to the south as an unnamed tributary to Fountain Lake Brook. The soil conditions in WL-14 were saturated and there was shallow standing water (~2 inches) in depressions throughout the wetland. Other indicators of wetland hydrology included water-stained leaves, aquatic fauna, and a high water table.

Vegetation Plot 1 (July 14, 2021)

Stratum	Plant Species
Tree	Yellow Birch, Sugar Maple, Red Spruce (*Picea rubens*)
Sapling/Shrub	Balsam Fir (*Abies balsamea*), Sugar Maple, Yellow Birch, Speckled Alder (*Alnus incana*)
Herb	Sensitive Fern (*Onoclea sensibilis*), Dwarf Enchanter's Nightshade (*Circaea alipina*), Dark-green Bullrush (*Scirpus atrovirens*), Common Marsh Bedstraw (*Galium palustre*), Dwarf Raspberry, Wood Fern, Nodding Sedge, Northeastern Manna Grass, *Epilobium spp., Lycopus spp.*

Vegetation Plot 2 (July 27, 2022)

Stratum	Plant Species
Tree	Yellow Birch, Sugar Maple, Red Spruce (*Picea rubens*)
Sapling/Shrub	Balsam Fir (*Abies balsamea*), Sugar Maple, Yellow Birch, Speckled Alder (*Alnus incana*), Red Spruce, Striped Maple (*Acer Pensylvanicum*),
Herb	Cinnamon Fern (*Osmundastrum cinnamomeum*), Sensitive Fern (*Onoclea sensibilis*), Dwarf Raspberry (*Rubus pubescens*), Nodding Sedge (*Carex gynandra*), Northeastern Manna Grass (*Glyceria melicaria*), Rough-stemmed Goldenrod (*Solidago rugosa*), *Geum spp., Glyceria striata*

Soil Profile 1 (July 14, 2021)

Depth	Matrix	Redox Features	Texture
0-10"	n/a	none	Sphagnum and other organics
10"+	Restrictive Layer	n/a	Cobbles

Soil Profile 2 (July 27, 2022)

Depth	Matrix	Redox Features	Texture
5-0"		n/a	Black Muck/ Decomposing Organics
0-5"	10YR 2/1 (100%)	n/a	Silty Clay
5"+	Restrictive Layer	n/a	Gravels

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Vegetation and Open Water in Wetland 14 (July 14, 2021)	Representative Photo of Wetland 14 (July 14, 2021)

Through flow Wetland 14 via WC3 (July 27, 2022)

Wetland 15 – Treed Swamp

Delineated total area: 0.42 ha.

Approximate area within PDA: 0.12 ha (29%)

Delineated: 27 July 2022

Hydrological Features: Drainage patterns, sparsely veg concave surfaces, drift deposits, aquatic fauna (frogs), saturated soils, sulphur smell, high water table (~35 cm below surface), moss trim lines, adventitious roots

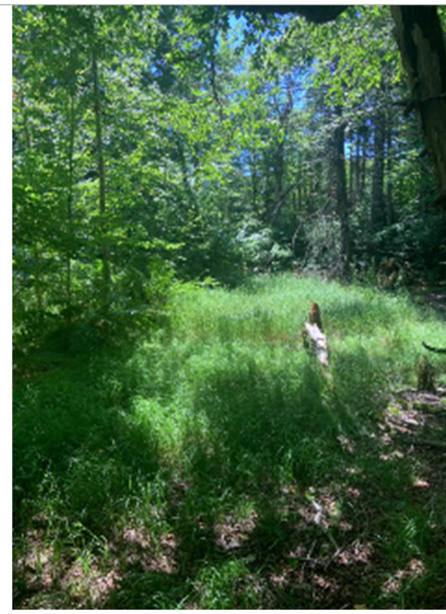
2022 Vegetation Profile of Wetland 15

Stratum	Plant Species
Tree	Yellow Birch, Red Spruce (*Picea rubens*), Red Maple
Sapling/Shrub	Yellow Birch, Balsam Fir, Red Maple
Herb	Cinnamon Fern, Sensitive Fern, Canada Bluejoint, Dwarf Raspberry, Marsh Skullcap, Jack-in-the-pulpit, *Dryopteris cristata,* Rattlesnake Mannagrass

2022 Soil Profile of Wetland 15

Depth	Matrix	Redox Features	Texture
1-0”	n/a	n/a	Duff layer of leaves and thatch
0-12”	7.5YR 2.5/1 (99%)	7.5YR 6/6 (1%)	Clay Loam
12-17”	7.5YR 5/1 (100%)	n/a	Clay with gravels
17”+	Restrictive Layer	n/a	Pale/white gravel

Representative Photos of Wetland 15



Appendix B

Wetland Functional Assessment WESP-AC Summaries

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Assessment Area (AA) Results:

Wetland ID: WL-1-WM

Date: July 14, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.578575 -63.787825

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.61	Lower	10.00	Higher	3.15	4.50
Stream Flow Support (SFS)	2.28	Moderate	8.14	Higher	1.83	5.42
Water Cooling (WC)	6.75	Higher	1.26	Lower	4.50	0.69
Sediment Retention & Stabilisation (SR)	3.32	Lower	0.00	Lower	4.79	0.00
Phosphorus Retention (PR)	3.03	Moderate	0.00	Lower	5.64	0.00
Nitrate Removal & Retention (NR)	2.31	Lower	1.00	Lower	4.44	1.00
Carbon Sequestration (CS)	2.42	Lower			6.34	
Organic Nutrient Export (OE)	10.00	Higher			6.54	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	4.96	Moderate	2.92	Moderate	5.52	2.82
Amphibian & Turtle Habitat (AM)	2.95	Lower	5.75	Higher	4.67	6.50
Waterbird Feeding Habitat (WBF)	4.04	Moderate	10.00	Higher	3.08	10.00
Waterbird Nesting Habitat (WBN)	3.77	Moderate	10.00	Higher	2.73	10.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.37	Moderate	10.00	Higher	6.41	10.00
Pollinator Habitat (POL)	7.53	Moderate	0.00	Lower	6.24	0.00
Native Plant Habitat (PH)	2.93	Lower	4.22	Lower	5.07	4.22
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			10.00	Higher		5.31
Wetland Ecological Condition (EC)			4.78	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			4.57	Moderate		2.38
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.61	Lower	10.00	Higher	3.15	4.50
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.04	Moderate	0.67	Lower	5.82	0.67
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	8.00	Higher	6.13	Moderate	5.57	4.20
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.10	Moderate	7.57	Higher	3.38	7.65
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	6.74	Moderate	7.37	Moderate	6.16	7.37
WETLAND CONDITION (EC)			4.78	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			7.29	Higher		3.85

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	16.09743326	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	2.02965162	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	48.99279972	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	23.45165871	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	49.66647221	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-2-WM

Date: July 12, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.585841 -63.729620

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.61	Lower	4.06	Moderate	4.64	1.80
Stream Flow Support (SFS)	1.52	Moderate	6.81	Moderate	1.22	4.53
Water Cooling (WC)	2.04	Moderate	1.36	Lower	1.36	0.74
Sediment Retention & Stabilisation (SR)	5.12	Moderate	8.57	Higher	6.19	4.20
Phosphorus Retention (PR)	1.26	Lower	8.04	Higher	4.53	6.25
Nitrate Removal & Retention (NR)	5.23	Higher	10.00	Higher	6.55	10.00
Carbon Sequestration (CS)	2.13	Lower			6.20	
Organic Nutrient Export (OE)	6.67	Moderate			4.36	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.11	Moderate	5.66	Moderate	5.58	4.29
Amphibian & Turtle Habitat (AM)	8.98	Higher	4.47	Moderate	7.83	5.45
Waterbird Feeding Habitat (WBF)	8.12	Higher	5.00	Moderate	6.18	5.00
Waterbird Nesting Habitat (WBN)	9.07	Higher	5.00	Higher	6.58	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	5.93	Moderate	10.00	Higher	5.16	10.00
Pollinator Habitat (POL)	5.82	Moderate	3.33	Moderate	4.82	3.33
Native Plant Habitat (PH)	2.27	Lower	4.44	Lower	4.81	4.44
Public Use & Recognition (PU)			2.95	Moderate		2.32
Wetland Sensitivity (Sens)			7.02	Moderate		4.17
Wetland Ecological Condition (EC)			0.43	Lower		5.42
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher		5.18
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.61	Lower	4.06	Moderate	4.64	1.80
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.33	Moderate	9.43	Higher	6.21	8.41
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.25	Moderate	5.71	Moderate	4.35	3.86
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.15	Higher	3.95	Moderate	5.97	4.27
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	5.30	Moderate	7.96	Moderate	5.05	7.96
WETLAND CONDITION (EC)			0.43	Lower		5.42
WETLAND RISK (average of Sensitivity & Stressors)			8.51	Higher		4.68

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	14.64072462	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	40.8671826	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	29.98626203	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	28.22813069	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	42.21728883	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Cover Page: Basic Description of Assessment	WESP-AC version 2
Site Name:	WL-3-WM
Investigator Name:	Chris Kennedy
Date of Field Assessment:	July 12, 2022
Nearest Town:	Westchester Mountain, NS
Latitude (decimal degrees):	45.578373
Longitude (decimal degrees):	-63.743095
Is a map based on a formal on-site wetland delineation available?	Yes
Approximate size of the Assessment Area (AA, in hectares):	3.67
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	70
What percent (approx.) of the wetland were you able to visit?	70
What percent (approx.) of the AA were you able to visit?	100
Were you able to ask the site owner/manager about any of the questions?	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	Yes
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	Yes
How many wetlands have you assessed previously using WESP-AC? (approx.)	200+
Comments about the site or this WESP-AC assessment (attach extra page if desired):	

Date: Octeber 14, 2022	Site Identifier: WL-3-WM	Investigator: Kelly Regan

Form OF (Office). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia wetlands only. DIRECTIONS: Conduct an assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answering many of the questions below will require using these online map viewers:

Google Earth Pro: https://www.google.com/earth/download/gep/agree.html

Provincial Landscape Viewer: https://nsgi.novascotia.ca/plv/

For most wetlands, completing this office data form will require 1-2 hours. For a list of functions to which each question pertains, see bracketed abbreviations in the Definitions/Explanations column. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
OF1	Province	Mark the province in which the AA is located by changing the 0 in the column next to it to a "1". Mark only one.		This determines to which province's calibration wetlands the raw score of any wetland is normalised. In the function and benefits models, it also triggers the automatic exclusion of indicators for which no spatial data exists in a particular province.		
		New Brunswick	0		NB	
		Nova Scotia	1		NS	
		Prince Edward Island	0		PEI	
		Newfoundland-Labrador	0		NL	
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		"Adjacent" means not separated from the AA by a wide expanse (>50 m) of upland (including roads >50 m wide). Include ponded areas likely to be hidden by wetland vegetation. If surface water extends beyond 1 km, include only the part within 1 km. Do not include tidal areas. Measure the area from aerial imagery using Google Earth Pro (click on Ruler icon in toolbar, then Polygon in pop-up menu). [PH, SBM, WBN]		
		<0.01 hectare (about 10 m x 10 m).	1			
		0.01 - 0.1 hectare.	0			
		0.1 - 1 hectare.	0			
		1 to 10 hectares.	0			
		10 to 100 hectares.	0			
		>100 hectares.	0			
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		See definition of adjacent in OF2. If the AA's wetland vegetation extends beyond 1 km, include only the part within 1 km. "Ponded" means not flowing in rivers or streams. [Sens, WBF]		
		<0.01 hectare (about 10 m x 10 m).	0			
		0.01 - 0.1 hectare.	0			
		0.1 - 1 hectare.	1			
		1 to 10 hectares.	0			
		10 to 100 hectares.	0			
		>100 hectares.	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:		See definition of adjacent in OF2. Use Google Earth Pro's polygon ruler (as described above). Exclude conifer plantations only if it is obvious that trees were planted in rows. [AM, PH, SBM, Sens]		
		<0.01 hectare (about 10 m x 10 m).	0			
		0.01 - 0.1 hectare.	0			
		0.1 - 1 hectare.	0			
		1 to 10 hectares.	0			
		10 to 100 hectares.	1			
		100 to 1000 hectares.	0			
		>1000 hectares. [*This is nearly always the answer in relatively undeveloped landscapes.*]	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest *vegetated land* (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:		To measure distance, use Google Earth Pro (Ruler > Line tool). The 375-ha criterion is from the Fundy Model Forest Project. [AM, PH, POL, SBM, Sens]		
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0			
		50-500 m, and not separated.	0			
		50-500 m, but separated by those features.	1			
		0.5 - 5 km, and not separated.	0			
		0.5 - 5 km, but separated by those features.	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0			
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1	For this question only, consider moss to be herbaceous vegetation. Determine the score by viewing aerial imagery in Google Earth after successively drawing or estimating the boundaries of the buffers of 5 km, 1 km, and 100 m radius focused on the center of the AA. Circles of specified radius can be drawn in Google Earth Pro by clicking on the Ruler icon, then Circle in the pop-up menu. [AMv, PHv, POLv, SBMv, WBFv, WBNv]		
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1	See above. Do not consider conifer plantations to be forest if it is obvious that trees were planted in rows. [AMv, PHv, POLv, SBMv]		

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:		In Google Earth, draw the 5 km buffer and then estimate land cover percentages, or do GIS analysis of an appropriate land cover layer. [AM, PH, POL, SBM, Sens]		
		<5% of the land.	0			
		5 to 20% of the land.	0			
		20 to 60% of the land.	1			
		60 to 90% of the land.	0			
		>90% of the land. SKIP to OF10.	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:		[AM, SBM]		
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:		"Population center" means a settled area with more than about 5 regularly- inhabited structures per square kilometer. In Google Earth Pro, click on the Ruler icon, then Path, and draw and measure the route. [FAv, FRv, NRv, PH, PU, SBM, WBFv]		
		<100 m.	0			
		100 - 500 m.	0			
		0.5- 1 km.	1			
		1 - 5 km.	0			
		>5 km.	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:		Determine this by viewing aerial imagery in Google Earth Pro and measuring with the Ruler>Line tool. [AM, FAv, FRv, NRv, PH, PU, SBM, STR, WBN]		
		<10 m.	0			
		10 - 25 m.	0			
		25 - 50 m.	0			
		50 - 100 m.	0			
		100 - 500 m.	0			
		>500 m.	1			
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0	Draw the 5 km circle in Google Earth Pro using the Circle tool and search for roads and wetlands within it, being alert for roads hidden under forest canopy. [AM, SBM, STR]		
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:		In Google Earth Pro, zoom in closely to examine the surrounding landscape for ponds, lakes, and wetlands that appear to be permanently flooded. [AM, PH, SBM, Sens, WBF, WBN]		
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0			
		<50 m, but completely separated by those features.	0			
		50-500 m, and not separated.	0			
		50-500 m, but separated by those features.	1			
		0.5 - 1 km, and not separated.	0			
		0.5 - 1 km, but separated by those features.	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:		Determine this by viewing aerial imagery in Google Earth. [Sens, WBF, WBN]		
		<100 m.	0			
		100 m - 1 km.	0			
		1 -2 km.	0			
		2-5 km.	1			
		5-10 km.	0			
		>10 km.	0			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:		In Google Earth, measure the distance to the ocean (including Bay of Fundy) or tidal river, whichever is closer. If you need to see how far upriver a river is tidal, see the KMZ file provided with this calculator for NS (NS Headtide). Points shown in those files are only an approximation, so local information if available may be preferable. [FA, WBF]		
		<100 m.	0			
		100 m - 1 km.	0			
		1 - 5 km.	0			
		5-10 km.	0			
		10-40 km.	1			
		>40 km.	0			
OF16	Upland Edge Contact	Select one:		[NR, SBM, Sens]		
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1			

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):		Contact local authories to determine if such maps exist. Where available, LiDAR imagery can provide finer elevational resolution useful for flood modeling. [WSv]		
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0			
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).	0.85	[FA, NR, Sens, SFSv, WCv, WSv]	ShedPos	
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0	If an ACCDC report is available for this AA, it also may contain such information. [NRv]		
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:		May use existing data, or sample those waters as part of this wetland assessment. "Harmful" should be evaluated with regard to current federal or provincial water quality standards. [AM, FA, FR, NRv, PRv, SRv, STR, WBF, WBN]		
		The condition is present within the AA.	0			
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0			
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0			
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1			
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:		May use existing data, or monitor waters as part of this wetland assessment. [NRv, PRv, SRv]		
		The condition is present within 1 km downslope and connected to the AA by a channel.	0			
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0			
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0			
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1			
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:		Topographic maps may be viewed online at the National Atlas of Canada (Toporama): http://atlas.gc.ca/toporama/en/index.html [NR, PR, Sens, SR, WS]		
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0			
		0.01 to 0.1.	0			
		0.1 to 1.	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :		[FA, INV, NRv, PRv, SRv, STR, WCv, WSv]		
		<10%.	1			
		10 to 25%.	0			
		>25%.	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:		[NRv, PRv, SRv, WSv]		
		Mostly true.	0			
		Somewhat true.	0			
		Mostly untrue.	1			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:		[AM, NR, SFS, WC, WS]		
		Northward (N, NE). north-facing contributing area.	0			
		Southward (S, SW). south-facing contributing area.	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:		Identify inlets and outlets, if any, from topographic maps (use elevations to determine which are inlets and which are outlets) and augment by field inspection. With the Provincial Landscape Viewer, select Nova Scotia Topo as the Basemap. Also enable the layer Forestry>WAM Predicted Flow. Then measure the inlet-outlet distance. [NR, OE, PR, SR, WS]		
		<10 m.	0			
		10 - 50 m.	0			
		50 - 100 m.	0			
		100 - 1000 m.	1			
		1- 2 km.	0			
		>2 km, or wetland lacks an inlet and outlet.	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903	This layer was provided by Dr. Dan McKenney of the Canadian Forest Service [AM, CS, FR, INV, NR, OE, PH, PR, Sens, SR, WBF, WCv, WS]	GrowD	

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [*Mark just the first choice that is true.]* :		Regarding the last choice, if uncertain if an AA is fishless, consider the possibility its waters have been stocked. [AM, FA, FR, INV, WBF, WBN]		
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites: http://www.salmonatlas.com/atlanticsalmon/canada-east/index.1.html http://atlanticsalmonfederation.org/rivers/introduction.html	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0			
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented *[mark all applicable]*:		Request information from ACCDC and/or conduct your own survey at an appropriate season using an approved protocol. For birds, also check eBird.org. NOTE for NS: If your WESP-AC is being completed for a Wetland Alteration Application to NS-ECC, your ACCDC results and any taxon-specific survey results must be submitted along with your WESP-AC results, and application. [AMv, EC, PHv, POLv, SBMv, Sens, WBFv, WBNv]		
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1			
		None of the above, or no data.	0			
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0	The source of this layer, which should be checked periodically for updates, is: http://www.ibacanada.com/mapviewer.jsp?lang=EN [SBMv, WBFv, WBNv]		
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.	0	This was provided by Dr. David Leske. [WBNv]		
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1	[SBM]		
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0	See: https://novascotia.ca/parksandprotectedareas/plan/interactive-map/ [PU]		
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0	[PU]		
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]		
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]		
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.		[AM, FA, FR, INV, PH]		
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.		"Private lands" may include those owned or leased by non-governmental organizations, e.g., charitable conservation land trusts, DUC, TNC. [PU, STR]		
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0			
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0			
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0			
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1			

Date: July 12, 2022	Site Identifier: WL-3-WM	Investigator: Chris Kennedy

Form F (Field). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia. DIRECTIONS: Walk for no less than 10 minutes from the wetland edge towards its core, in the part of the AA that is proposed for alteration. If no alteration is proposed, walk in a portion that appears to be most representative of the wetland overall. Walk only where it is safe and legal to do so. Conduct the assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answer these questions primarily based on your onsite observations and interpretations. Do not write in shaded parts of this data form. Answering some questions accurately may require conferring with the landowner or other knowledgable persons, and/or reviewing aerial imagery. For most wetlands, completing this field data form will require 1-2 hours on a site. For a list of functions to which each question pertains, see the accompanying Interpretations form. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage & Delay, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:		Ericaceous shrubs are ones in the heather family (Ericaceae). Most have leathery evergreen leaves. They include rhododendron, azalea, swamp laurel, leatherleaf, Labrador tea, and others. Most require acidic soil. Although not in the family Ericaceae, sweetgale (*Myrica gale*) should be counted also. [AM, CS, FA, FR, INV, NR, OE, PH, Sens, SFS, WBF, WBN]		
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.				
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (*Carex rariflora*). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0		Fen_	
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:				
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1			
		B2. Not B1. Tree & tall shrubs comprise less than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0		Marsh	
		<u>Reminder</u>: For all questions, the AA should include all persistent waters in ponds smaller than 8 hectares (~283 m on a side) that are adjacent to the AA. The AA should also include part of the water area of adjacent ponded water larger than 8 ha and adjacent rivers wider than 20 m. Specifically, the AA should include the open water part adjacent to wetland vegetation and equal in width to the average width of that vegetated zone. Throughout this data form, "adjacent" is used synonymously with abutting, adjoining, bordering, contiguous -- and means no upland (manmade or natural) completely separates the described features along their directly shared edge. Features joined only by a channel are not necessarily considered to be adjacent -- a large portion of their edges must match. The features do not have to be hydrologically connected in order to be considered adjacent.				
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, INV, SBM, WBF]		
		A1.	0			
		A2.	0			
		B1.	0			
		B2.	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.		Deciduous shrubs in this region usually include buttonbush, Labrador tea, bayberry (*Morella*), huckleberry, cranberry, cloudberry, sweetgale, alder, willow, birch, ash, dogwood, and a few others. If you assigned a code of 3 or higher to any of the first four choices and the ground cover beneath the trees/shrubs is <25% moss, then question F1 might be "B1". [CS, INV, NR, PH, POL, SBM, Sens]		
		coniferous trees (may include tamarack) taller than 3 m.	2			
		deciduous trees taller than 3 m.	1			
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1			
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	2			
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1			
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1			
		<u>Note</u>: If none of top 4 rows in F3 was marked 2 or greater, SKIP to F9 (N fixers).				
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover. Then choose one:		[PH, POL, SBM, Sens]		
		those species together comprise > 50% of such cover.	1			
		those species together do not comprise > 50% of such cover.	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.		Estimate the diameters at chest height. If small-diameter trees are overtopped (shaded) by larger ones, visualise a "subcanopy" at the average height of the smaller-dbh trees, to serve as a basis for the minimum 5% canopy requirement in this question. The trees and shrubs need not be wetland species. [AM, CS, POL, SBM, Sens, WBN]		
		coniferous, 1-9 cm diameter and >1 m tall.	1			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1			
		coniferous, 10-19 cm diameter.	1			
		broad-leaved deciduous 10-19 cm diameter.	0			
		coniferous, 20-40 cm diameter.	0			
		broad-leaved deciduous 20-40 cm diameter.	0			
		coniferous, >40 cm diameter.	0			
		broad-leaved deciduous >40 cm diameter.	0			

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:		[AM, INV, NR, PH, SBM, Sens]		
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.				
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:				
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:		Snags are dead standing trees that often (not always) lack bark and foliage. Include only ones that are at least 2 m tall. [POL, SBM, WBN]		
		None, or fewer than 8/ hectare which exceed this diameter.	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0			
		Several (>8/hectare) but above not true.	1			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:		Exclude temporary "burn piles." [AM, INV, POL, SBM]		
		Few or none that meet these criteria.	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:		Do not include N-fixing algae or lichens. [FA, FR, INV, NRv, OE, PH, SBM, Sens]		
		<1% or none.	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0			
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:		Exclude moss growing on trees and rocks. [CS, PH]		
		<5% of the vegetated part of the AA.	0			
		5-25% of the vegetated part of the AA.	1			
		25-50% of the vegetated part of the AA.	0			
		50-95% of the vegetated part of the AA.	0			
		>95% of the vegetated part of the AA.	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:		Thatch is dead plant material (stems, leaves) resting on the ground surface. Bare ground that is present under a tree or shrub canopy should be counted. Boulders count as bare ground. Wetlands with mineral soils and that are heavily shaded or are dominated by annual plant species tend to have more extensive areas that are bare during the early growing season. [AM, EC, INV, NR, OE, POL, PR, SBM, Sens]		
		Little or no (<5%) *bare ground* is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0			
		Other conditions.	0			
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:		The depressions may be of human or natural origin. [AM, EC, INV, NR, PH, POL, PR, SBM, SR, WS]		
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0			
		Intermediate.	0			
		Several (extensive micro-topography).	1			
F13	Upland Inclusions	Within the AA, inclusions of upland are:		[AM, NR, SBM]		
		Few or none.	0			
		Intermediate (1 - 10% of vegetated part of the AA).	1			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [*To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]*		[CS, NR, OE, PH, PR, Sens, SFS, WS]		
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1			
		Deep Peat, to 40 cm depth or greater.	0			
		Shallow Peat or organic <40 cm deep.	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0			
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]		This addresses needs of many but not all migratory sandpipers, plovers, and related species. [WBF]		
		None, or <100 sq. m.	1			
		100-1000 sq. m.	0			
		1000 – 10,000 sq. m.	0			
		>10,000 sq. m.	0			

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:		[AM, WBF, WBN]		
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0		NoHerbCov	
		5-25% of the vegetated part of the AA.	1			
		25-50% of the vegetated part of the AA.	0			
		50-95% of the vegetated part of the AA.	0			
		>95% of the vegetated part of the AA.	0			
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:		Forbs are flowering plants. Do not include grasses, sedges, cattail, other graminoids, ferns, horsetails, or others that lack showy flowers. [POL]		
		<5% of the herbaceous part of the AA.	0			
		5-25% of the herbaceous part of the AA.	1			
		25-50% of the herbaceous part of the AA.	0			
		50-95% of the herbaceous part of the AA.	0			
		>95% of the herbaceous part of the AA.	0		AllForbCov	
F18	Sedge Cover	Sedges (*Carex* spp.) and cottongrass (*Eriophorum* spp.) occupy:		[CS]		
		<5% of the vegetated area, or none.	1			
		5-50% of the vegetated area.	0			
		50-95% of the vegetated area.	0			
		>95% of the vegetated area.	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:		For this question, include ferns as well as graminoids and forbs. [EC, INV, PH, POL, Sens]		
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.		[EC, PH, POL, Sens]		
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0			
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:		If a plant cannot be identified to species (e.g., winter conditions) but its genus contains an exotic species, assume the unidentified plant to also be exotic. If vegetation is so senesced that exotic species cannot be identified, answer "none". [PH, STR]		
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1			
		some (but <5%) of the upland edge.	0			
		5-50% of the upland edge.	0			
		most (>50%) of the upland edge.	0			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0	[WBF, WBN, WCv]		
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0	[FR, PR, PU, WBF, WBN]		
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, FA, FR, INV, NR, PH, PR, SBM, Sens, SRv, WBF, WBN, WC]		
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0			
		25-50% of the AA never contains surface water.	1			
		50-75% of the AA never contains surface water.	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0		AllSat2	
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0		AllSat1	
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:		If you are unable to determine the condition at the driest time of year, ask the land owner or neighbors about it if possible. Indicators of persistence may include fish, some dragonflies, beaver, and muskrat. [AM, CS, FA, FR, INV, NR, POL, PR, SBM, WBF, WBN]		
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0		NoPersis	
		1-20% of the AA.	1			
		20-50% of the AA.	0			
		50-95% of the AA.	0			
		>95% of the AA. True for many fringe wetlands.	0		AllWet	
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water <u>within</u> the AA that is shaded by vegetation and other features that are <u>within</u> the AA at that time is:		[FA, WC]		
		<5% of the water is shaded, or no surface water is present then.	0			
		5-25% of the water is shaded.	0			
		25-50% of the water is shaded.	0			
		50-75% of the water is shaded.	0			
		>75% of the water is shaded.	1			

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:		Flood marks (algal mats, adventitious roots, debris lines, ice scour, etc.) are often evident when not fully inundated. Also, such areas often have a larger proportion of upland and annual (vs. perennial) plant species. In riverine systems, the extent of this zone can be estimated by multiplying by 2 the bankful height and visualising where that would intercept the land along the river. [CS, FA, INV, NR, OE, PH, SR, WBF, WBN, WS]		
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0		NoSeasonal	
		1-20% of the AA, or <1% but >0.01 ha.	0			
		20-50% of the AA.	1			
		50-95% of the AA.	0			
		>95% of the AA.	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:		Look for flood marks (see above). Because the annual range of water levels is difficult to estimate without multiple visits, consider asking the land owner or neighbors about it. [AM, CS, INV, NR, OE, PH, PR, SR, WBN, WS]		
		<10 cm change (stable or nearly so).	0			
		10 cm - 50 cm change.	1			
		0.5 - 1 m change.	0			
		1-2 m change.	0			
		>2 m change.	0			
Is the AA plus adjacent ponded water smaller than 0.01 hectare (about 10m x 10m, or 1m x 100 m)? If so, enter "1" in column D and SKIP TO F42 (Connection).			0		TooSmall	
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:		If a boat is unavailable, estimate this by considering wetland size and local topography. Or if timing and safety allow, depths may be measured by drilling through winter ice.This question is asking about the spatial median depth that occurs during most of that time, even if inundation is only seasonal or temporary. If inundation in most but not all of the wetland is brief, the answer will be based on the depth of the most persistently inundated part of the wetland. Include surface water in channels and ditches as well as ponded areas. [CS, FA, FR, INV, OE, PH, PR, Sens, SFS, SR, WBF, WBN, WC]		
		<10 cm deep (but >0).	0			
		10 - 50 cm deep.	1			
		0.5 - 1 m deep.	0			
		1 - 2 m deep.	0			
		>2 m deep. True for many fringe wetlands.	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):		Estimate these proportions by considering the gradient and microtopography of the site. [FR, INV, WBF, WBN]		
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question above).	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:		Nearly all wetlands with surface water have some ponded water. [AM, CS, INV, NR, OE, PR, Sens, SR, WBF, WBN, WC, WS]		
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1		NoPonded	
		5-30% of the water.	0			
		30-70% of the water.	0			
		70-95% of the water.	0			
		>95% of the water.	0			
F32	Ponded Open Water - Minimum Size	During most of the growing season, the largest patch of open water that is ponded and is in or bordering the AA is >0.01 hectare (about 10 m by 10 m) and mostly deeper than 0.5 m. If true enter "1" and continue, If false, enter "0" and SKIP to F41 (Floating Algae & Duckweed).	0	Open water is not obscured by vegetation in aerial ("duck's eye") view. It includes vegetation floating on the water surface or entirely submersed beneath it.	OpenW	
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:		[AM, CS, FA, FR, INV, NR, OE, PR, SR, WBF, WBN, WC]		
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0		NoOpenPonded	
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0		NoOpenPonded1	
		5-30% of the ponded water.	0			
		30-70% of the ponded water.	0			
		70-99% of the ponded water.	0			
		100% of the ponded water.	0		AllOpenPond	
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area <u>in the AA</u> that separates adjoining uplands from open water within the AA is:		"Vegetated area" does not include underwater or floating-leaved plants, i.e., aquatic bed. Width may include wooded riparian areas if they have wetland soil or plant indicators. [AM, CS, NR, OE, PH, PR, SBM, Sens, SR, WBN]		
		<1 m.	0			
		1 - 9 m.	0			
		10 - 29 m.	0			
		30 - 49 m.	1			
		50 - 100 m.	0			
		> 100 m, or open water is absent at that time.	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water) is:		If several isolated pools are present in early summer, estimate the percent of their collective shorelines that has such a gentle slope. [SR, WBN]		
		<1% of the water edge.	0			
		1-25% of the water edge.	0			
		25-50% of the water edge.	0			
		50-75% of the water edge.	0			
		>75% of the water edge.	1			
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (*Typha* spp.), common reed (*Phragmites*), or tall (>1m) bulrush is:		Emergent vegetation is herbaceous plants whose stems are partly above and partly below the water surface during most of the time water is present. [WBN]		
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1		NoRobustEm	
		1-25% of the emergent vegetation.	0			
		25-75% of the emergent vegetation.	0			
		>75%, of the emergent vegetation.	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:		[AM, FA, FR, INV, NR, OE, PH, PR, SBM, SR, WBF, WBN]		
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0			
		Intermediate.	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0			
F38	Persistent Deepwater Area	If the deepest patch of surface water (flowing or ponded) in or directly adjacent to the AA is mostly deeper than 0.5 m for >2 weeks during the growing season, enter "1" and continue. If not, enter "0" and SKIP to F42.(Connection).	0		DeepPersis	

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:		For this question, consider only the wood that is at or above the water surface. Estimates of underwater wood based only on observations from terrestrial viewpoints are unreliable so should not be attempted. [AM, FA, FR, INV]		
		Little or none.	0			
		Intermediate.	0			
		Extensive.	0			
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0	[WBN]		
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0	[EC, PR, WBF]		
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]		Consider the connection regardless of whether the surface water is frozen. The "downslope stream network" could consist of ditches, rivers, ponds, or lakes which eventually connect to the ocean. If this cannot be determined while visiting the AA, consult topographic maps perhaps by viewing these online with Toporama (http://atlas.nrcan.gc.ca/toporama/en/index.html) [CS, FA, FR, NR, OE, PR, Sens, SFS, SR, WCv, WS]		
		Persistent (surface water flows out for >9 months/year).	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0		OutNone1	
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0		Outnone	
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:		"Major runoff events" would include biennial high water caused by storms and/or rapid snowmelt. [CS, NR, OE, PR, Sens, SR, STR, WS]		
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1	If inlet tributaries cannot be searched for due to inaccessibility of part of the AA, follow suggestions in F42 above. [NRv, PH, PRv, SRv]	Inflows	
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	0	[WCv]		
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].		[FA, FR, INV, NR, OE, PR, SR, WS]		
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0			
F47	pH Measurement	The pH in most of the AA's surface water:		Preferably, measure this in larger areas of ponded surface water within the AA, or in streams that have passed through (not along) most of the AA. Unless surface water is completely absent, do not dig holes or make depressions in peat in order to provide water for this measurement. Avoid measuring near roads or in puddles formed only by recent rain. [AM, FA, FR, NR, WBF, PH, PR, Sens, WBF, WBN]		
		Was measured, and is: [*enter the reading in the column to the right.*]	7.1			
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".				
		Neither of above. Enter "1".	0			
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):		See above for measurement guidance. [FR, INV, NRv, PH, PRv, Sens]		
		TDS is: [*Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.*]	19			
		Conductivity is [*Enter the reading in µS/cm in the column to the right.*]	36			
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0			
		Neither of above	0			
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):		[FA, FR, PH, SBM, Sens, WBF, WBN]		
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:		Adhere to these criteria strictly -- do not use personal judgment based on fen conditions, pH, or other evidence. Consult topographic maps to detect breaks in slope described here. Rust deposits associated with groundwater seeps may be most noticeable as orange discoloration in ice formations along streams during early winter. [AM, CS, FA, FR, INV, NR, OE, PH, PRv, SFS, WC, WS]		
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1			

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
F51	Internal Gradient	The gradient along most of the flow path within the AA is:		This is not the same as the shoreline slope. It is the elevational difference between the AA's inlet and outlet, divided by the flow-distance between them and converted to percent. If available, use a clinometer to measure this. Free clinometer apps can be downloaded to smartphones. If the wetland is large (longer than ~1 km), this may be estimated using Google Earth to determine the minimum and maximum elevation within the AA, then dividing by length and multiplying by 100. [CS, NR, OE, PR, SR, WBF, WBN, WS]		
		<2% or the AA has no surface water outlet (not even seasonally).	0			
		2-5%.	1			
		6-10%.	0			
		>10%.	0		TooSteep	
Note for the next three questions: If the AA lacks an upland edge, evaluate based on the AA's entire perimeter, and moving outward into whatever areas are adjacent. In many situations, these questions are best answered by measuring from aerial images.						
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:		[AM, FA, FR, INV, NRv, PH, POL, PRv, SBM, Sens, SRv, STR, WBN]		
		<5%.	0			
		5 to 30%.	0			
		30 to 60%.	1			
		60 to 90%.	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0		BuffAllNat	
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):		[AM, FA, INV, NRv, PH, POL, SBM, STR, WBN]		
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:		[NRv, PRv, Sens, SRv]		
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0			
		2-5%.	0			
		5-30%.	1			
		>30%.	0			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	Do not include upturned trees as potential den sites. [POL, SBM]		
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):		Determine this using historical aerial photography, old maps, soil maps, or permit files as available [CS, NR, OE, PH, Sens]		
		No.	0			
		Yes, and created or expanded 20 - 100 years ago.	0			
		Yes, and created or expanded 3-20 years ago.	0			
		Yes, and created or expanded within last 3 years.	0			
		Yes, but time of origin or expansion unknown.	0			
		Unknown if new or expanded within 20 years or not.	1			
F57	Burn History	More than 1% of the AA's previously vegetated area:		Look for charred soil or stumps (in multiple widely-spaced locations) or ask landowner. [CS, PH, STR]		
		Burned within past 5 years.	0			
		Burned 6-10 years ago.	0			
		Burned 11-30 years ago.	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1			
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:		[PU, STR, WBFv]		
		<25%.	1			
		25-50%.	0			
		>50%.	0			
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:		[PU, STR]		
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	0			
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1			
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: *[Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]*		[AM, FAv, FRv, PH, PU, SBM, STR, WBF, WBN]		
		<5% and no inhabited building is within 100 m of the AA.	0			
		<5% and inhabited building is within 100 m of the AA.	0			
		5-50% and no inhabited building is within 100 m of the AA.	0			
		5-50% and inhabited building is within 100 m of the AA.	0			
		50-95%, with or without inhabited building nearby.	0			
		>95% of the AA with or without inhabited building nearby.	1			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: *[See note above.]*		[AM, PH, PU, SBM, STR, WBF, WBN]		
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1			
		5-50%.	0			
		50-95%.	0			
		>95% of the AA.	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0	[PH, PU]		
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	[AM, PU, WBF, WBN]		
F64	Consumptive Uses (Provisioning	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select ALL that apply.		[FAv, FRv, WBFv]		

#	Indicators	Condition Choices	Data	Definitions/Explanations	Cell Name	Comments
	(Provisioning Services)	Low-impact commercial timber harvest (e.g., selective thinning).	0			
		Commercial or traditional-use harvesting of native plants, their fruits, or mushrooms.	0			
		Waterfowl hunting.	0			
		Fishing.	0			
		Trapping of furbearers.	0			
		None of the above.	1			
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:		[NRv]		
		Within 0-100 m. of the AA.	0			
		100-500 m. away.	0			
		>500 m. away, or no information.	1			
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0	[PH, PR]		

Investigator: Chris Kennedy	Site Identifier: WL-3-WM		Date: July 12, 2022	
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S1 Aberrant Timing of Water Inputs				
In the last column, place a check mark next to any item that is likely to have caused the timing of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either more muted (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) or more flashy (larger or more frequent spikes but over shorter times). [FA, FR, INV, PH, STR]				
Stormwater from impervious surfaces that drains directly to the wetland.				0
Water subsidies from wastewater effluent, septic system leakage, snow storage areas, or irrigation.				0
Regular removal of surface or groundwater for irrigation or other consumptive use.				0
Flow regulation in tributaries or water level regulation in adjoining water body, or other control structure at water entry points that regulates inflow to the wetland.				0
A dam, dike, levee, weir, berm, or fill -- within or downgradient from the wetland -- that interferes with surface or subsurface flow in/out of the AA (e.g., road fill, wellpads, pipelines).				0
Excavation within the wetland, e.g., dugout, artificial pond, dead-end ditch.				0
Artificial drains or ditches in or near the wetland.				0
Accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level).				0
Logging within the wetland.				1
Subsidence or compaction of the wetland's substrate as a result of machinery, livestock, fire, drainage, or off road vehicles.				1
Straightening, ditching, dredging, and/or lining of tributary channels.				
If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Spatial extent of timing shift within the wetland:	>95% of wetland.	5-95% of wetland.	<5% of wetland.	2
When most of the timing shift began:	<3 yrs ago.	3-9 yrs ago.	10-100 yrs ago.	1
Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.				
Input timing now vs. previously:	Shift of weeks.	Shift of days.	Shift of hours or minutes.	0
Flashiness or muting:	Became very flashy or controlled.	Intermediate.	Became mildly flashy or controlled.	0
			Sum=	3
			Stressor subscore=	0.25
S2 Accelerated Inputs of Contaminants and/or Salts				
In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of contaminants or salts to the AA. [AM, FA, PH, POL, STR]				
Stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities.				0
Metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (download many locations from National Pollutant Release Inventory and view KMZ overlay in Google Earth. https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=B85A1846-1				0
Road salt.				0
Spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA.				1
If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Usual toxicity of most toxic contaminants:	Industrial effluent, mining waste, unmanaged landfill.	Cropland, managed landfill, pipeline or transmission rights-of-way.	Low density residential.	2
Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	2
			Sum=	5
			Stressor subscore=	0.56

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S3 Accelerated Inputs of Nutrients

In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of nutrients to the wetland. [NRv, PRv, STR]

Stormwater or wastewater effluent (including failing septic systems), landfills.	0
Fertilizers applied to lawns, ag lands, or other areas in the CA.	1
Livestock, dogs.	0
Artificial drainage of upslope lands.	0

If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	Data
Type of loading:	High density of unmaintained septic, some types of industrial sources.	Moderate density septic, cropland, secondary wastewater treatment plant.	Livestock, pets, low density residential.	2
Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	2
			Sum=	5
			Stressor subscore=	0.56

S4 Excessive Sediment Loading *from Contributing Area*

In the last column, place a check mark next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA. [FA, FR, INV, PH, SRv, STR]

Erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires.	1
Erosion from construction, in-channel machinery in the CA.	0
Erosion from off-road vehicles in the CA.	0
Erosion from livestock or foot traffic in the CA.	0
Stormwater or wastewater effluent.	0
Sediment from road sanding, gravel mining, other mining, oil/ gas extraction.	0
Accelerated channel downcutting or headcutting of tributaries due to altered land use.	0
Other human-related disturbances within the CA.	0

If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.

	Severe (3 points)	Medium (2 points)	Mild (1 point)	Data
Erosion in CA:	Extensive evidence, high intensity.*	Potentially (based on high-intensity* land use) or scattered evidence.	Potentially (based on low-intensity* land use) with little or no direct evidence.	1
Recentness of significant soil disturbance in the CA:	Current & ongoing.	1-12 months ago.	>1 yr ago.	0
Duration of sediment inputs to the wetland:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	0
AA proximity to actual or potential sources:	0 - 15 m.	15-100 m.	In more distant part of contributing area.	0
* high-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; low-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment.			Sum=	1
			Stressor subscore=	0.08

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S5	Soil or Sediment Alteration *Within the Assessment Area*				
	In the last column, place a check mark next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil. Consider only items occurring within past 100 years or since wetland was created or restored (whichever is less). [CS, INV, NR, PH, SR, STR]				
	Compaction from machinery, off-road vehicles, livestock, or mountain bikes, especially during wetter periods.				1
	Leveling or other grading not to the natural contour.				1
	Tillage, plowing (but excluding disking for enhancement of native plants).				0
	Fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland.				1
	Excavation.				0
	Ditch cleaning or dredging in or adjacent to the wetland.				0
	Boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments.				0
	Artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments.				0
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Spatial extent of altered soil:	>95% of wetland or >95% of its upland edge (if any).	5-95% of wetland or 5-95% of its upland edge (if any).	<5% of wetland and <5% of its upland edge (if any).	2
	Recentness of significant soil alteration in wetland:	Current & ongoing.	1-12 months ago.	>1 yr ago.	1
	Duration:	Long-lasting, minimal veg recovery.	Long-lasting but mostly revegetated.	Short-term, revegetated, not intense.	2
	Timing of soil alteration:	Frequent and year-round.	Frequent but mostly seasonal.	Mainly during one-time or scattered events.	1
				Sum=	6
				Stressor subscore=	0.50

Assessment Area (AA) Results:

Wetland ID: WL-3-WM

Date: July 12, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.578373 -63.743095

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.54	Lower	4.79	Moderate	3.09	2.13
Stream Flow Support (SFS)	3.38	Moderate	10.00	Higher	2.72	6.84
Water Cooling (WC)	7.70	Higher	6.93	Higher	5.13	3.76
Sediment Retention & Stabilisation (SR)	4.00	Moderate	8.73	Higher	5.31	4.28
Phosphorus Retention (PR)	0.59	Lower	8.04	Higher	4.12	6.25
Nitrate Removal & Retention (NR)	3.45	Moderate	10.00	Higher	5.26	10.00
Carbon Sequestration (CS)	1.08	Lower			5.71	
Organic Nutrient Export (OE)	8.22	Higher			5.38	
Anadromous Fish Habitat (FA)	6.96	Higher	2.95	Moderate	4.56	1.87
Resident Fish Habitat (FR)	7.34	Higher	2.68	Moderate	3.99	1.67
Aquatic Invertebrate Habitat (INV)	8.52	Higher	6.96	Higher	6.97	4.99
Amphibian & Turtle Habitat (AM)	5.20	Moderate	4.28	Moderate	5.85	5.29
Waterbird Feeding Habitat (WBF)	5.73	Moderate	3.33	Moderate	4.37	3.33
Waterbird Nesting Habitat (WBN)	4.17	Moderate	3.33	Moderate	3.02	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.37	Higher	10.00	Higher	8.16	10.00
Pollinator Habitat (POL)	8.22	Higher	3.33	Moderate	6.81	3.33
Native Plant Habitat (PH)	4.99	Moderate	6.10	Moderate	5.89	6.10
Public Use & Recognition (PU)			1.95	Moderate		1.64
Wetland Sensitivity (Sens)			7.80	Higher		4.39
Wetland Ecological Condition (EC)			10.00	Higher		10.00
Wetland Stressors (STR) (higher score means more stress)			7.94	Higher		4.00
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.54	Lower	4.79	Moderate	3.09	2.13
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.14	Moderate	9.46	Higher	5.40	8.42
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.74	Higher	8.98	Higher	6.01	6.02
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.61	Higher	3.80	Moderate	5.10	4.19
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.45	Higher	8.24	Moderate	7.55	8.24
WETLAND CONDITION (EC)			10.00	Higher		10.00
WETLAND RISK (average of Sensitivity & Stressors)			7.87	Higher		4.20

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: (1) Support Supergroup - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. (2) Habitat Supergroup - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score AND Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	7.370953739	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	29.68146924	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	69.50570649	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	25.10165373	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	69.60470301	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	Site is not a WSS

Water Storage & Delay		The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	WS					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	If a wetland is capable of storing runoff, its positive effect on controlling downslope flood peaks is greater if it is large relative to the volume of runoff it receives, which is reflected somewhat by the extent of its contributing area. Wetlands that comprise a large portion of their contributing area have a greater potential to control the runoff arriving from that limited area.	CApct1
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.67	North-facing slopes are likely to remain frozen for longer periods, thus limiting the soil's capacity to store or infiltrate runoff.	Aspect1
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	0	3	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	2	2			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	The longer the hydrologic path length, the greater the friction provided and thus the most effective a wetland potentially is at slowing or desynchonizing the downslope movement of runoff.	FloDist1
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer parts of the region imply a longer period of time during which the ground remains unfrozen and during which vegetation can potentially remove water via evapotranspiration.	_GDD1
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Large variation in elevations within a wetland, both at a micro- (~1 m) and macro (>10m) scale, suggest greater potential for trapping and retaining snow and other precipitation sufficiently long to allow runoff to infiltrate or evaporate from the wetland and thus delay or avoid its entry into downslope rivers (Kadlec et al. 1981, Price et al. 1990).	Girreg1
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	1	0			
		Intermediate.	0	2	0			
		Several (extensive micro-topography).	1	3	3			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	Considerable amounts of water can be stored below the land surface in peat and coarse-textured substrates. However, very little new runoff can be stored if the substrates are already saturated. Peat tends to be saturated much of the time, and groundwater discharge dominates many wetlands with coarse-textured substrate, keeping those saturated much of the time and thus limiting the capacity to store additional water. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water. Runoff ratio is greatest in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Quinton et al. 2003, Emili & Price 2006).	SoilTex
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	This directly estimates the relative amount of horizontal space in which precipitation and runoff are being stored, at least temporarily. The ability of wetland water storage to reduce stream peak flows is greatest in summer and fall, where those are the driest times of year (Roulet & Woo 1988, Quinton & Roulet 1998). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	This directly estimates the relative amount of vertical space in which precipitation and runoff are being stored, at least temporarily. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fluctua
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding indicates water is in storage rather than being transferred immediately downslope. Water distributed in small pools is more subject to loss via evapotranspiration before it can exit a wetland, and this delay can measurably reduce peak outflows (Price & Maloney 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	0	0			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that store water only temporarily or seasonally have longer periods during the year in which soils are unsaturated and thus able to briefly store or delay additional water from precipitation and runoff. Wetland connectivity is key to estimating wetland water storage: wetlands that lack an outlet (never have any outflow) store or dissipate (via evaporation or seepage) nearly all the water they receive (Spence et al. 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus increasing storage (Carter et al. 1979). The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	3	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	2	2			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.75	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the outflow and downstream movement of water (Price & Woo 1988). This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods), and is tall and stiff enough to provide some resistance (Arcement & Schneider 1989). However, woody vegetation itself occupies space otherwise available for storing water (this effect is usually negligible). Water also takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. Also is excluded automatically if no surface inflow.*	ThruFlo
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	3	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	4	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	6	6			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands fed constantly by groundwater are likely to have only limited subsurface storage space for storing additional precipitation. However, they may remain unfrozen for longer periods. *In calculations, is excluded automatically (cell goes blank) if no strong evidence of groundwater (last choice).*	Groundw
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	1	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	3	3			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.60	Sloping wetlands retain surface runoff and precipitation for shorter times.	Gradient
		<2% or the AA has no surface water outlet (not even seasonally).	0	5	0			
		2-5%.	1	3	3			
		6-10%.	0	2	0			
		>10%.	0	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):				0.00	Storage by wetlands is obviously more valuable when properties located downslope might otherwise be flooded. The need for (and value of) storage potentially provided by wetlands is greater when floodable property downslope is not being adequately protected by other water storage or detention features.	FloodBdg
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	4	0			
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	1	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	2	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	0	0			
OF23	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.85	Wetlands that store floodwater are more valuable if they are in the headwaters of a watershed, placing them above areas which might otherwise be damaged by floods.	ShedPos1
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) storage potentially provided by wetlands is greater when upland runoff is rapid, as occurs when much of the contributing area contains impervious surface (Laenen 1980, Waite et al. 2006). In contributing areas with extensive impervious surface, the proportion of stream flow due to surface runoff can be as much as five times that seen in forested catchments (Arnold & Gibbons 1996). The increase in surface runoff due to urbanization is especially greater in the Pacific Northwest due the naturally high infiltration capacity of the soils and the low intensity of the rainfall, which makes surface runoff a rare phenomenon in undeveloped watersheds (Booth & Jackson 1997). Increased surface runoff causes a shortening of the lag time between precipitation and stream flow response (Hirsch et al. 1990). The effect is higher peak flows but of shorter duration than those in forested catchments receiving comparable rainfall (Leopold 1968). *In calculations, is ignored (cell goes blank) if wetland appears to have no contributing area.*	CAunveg
		<10%.	1	0	0			
		10 to 25%.	0	3	0			
		>25%.	0	4	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00		Transport
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			

Subsurface Storage (Infiltration Capacity & ET)	0.42	[3*AVERAGE(SoilTex, Groundw, CApct) + AVERAGE(GDD, Aspect)] /4	Subsurf
Live Store	0.45	IF((AllSat1=1), blank, AVERAGE(Fluctua, SeasPct))	LiveStore
Friction	0.47	IF((AllSat1=1), (3*Gradient +AVERAGE(Gcover, Girreg))/4, ELSE: AVERAGE(Gradient, Constric, ThruFlo, FloDist, IsoDry)	Friction

Function Score for Water Storage	F	3.09	IF((AllSat1=1), AVERAGE [(OutDura, AVERAGE(Subsurface, Friction)], ELSE: AVERAGE [OutDura, (4*LiveStore + 2*Friction + Subsurf)/7))]
Benefits Score for Water Storage	B	2.13	IF((FloodBdg=1), 1, AVERAGE(FloodBdg, AVERAGE: (ShedPos, CAunveg, Transport))

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Stream Flow Support	The effectiveness for extending flow duration into drier parts of a growing season.	SFS

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	Snow tends to accumulate more on north-facing slopes due to less sun exposure, and water losses from evapotranspiration are less. Consequently, streamflow fed by such slopes may persist longer into drier periods.	Aspect2_
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	0	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Many or most fens are groundwater discharge areas (Siegel & Glaser 1987), and such discharge is more seasonally stable and thus more likely to contribute water late in the season when streamflow otherwise can be low. Some bogs, especially those that have outlets, discharge groundwater and thus potentially influence low flows (Siegal 1988). Where located near the Maritime coast, they lose relatively little water to evaporation and infiltration (Price 1992). Much of their water is released later in the spring and summer than in other wetland types, due to its remaining frozen later on account of the insulating effects of peat (Price & Maloney 1994). Water tables in riparian swamps and marshes typically fluctuate with river levels, and so are less likely to contribute much water during low flow conditions.	Wettype2
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	3	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	4	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	Peat soils retain water for longer periods than coarse mineral soils, and the deeper the better. Subsurface ice which helps sustain streamflow also may remain longer into the late spring in peatlands due to the insulating effects of peat. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water (Wiley & Curran 2003). Runoff ratio is greatest (surface water retention is least) in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Emili & Price 2006)	Soil2_
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Deeper water implies greater water volume to potentially feed downslope streams. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth2_
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	3	0			
		>2 m deep. True for many fringe wetlands.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	This is the primary indicator of a wetland's potential for supporting summer flow in connected downslope streams.	OutDur2_
		Persistent (surface water flows out for >9 months/year).	1	6	6			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	3	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Wetlands fed by groundwater tend to remain saturated for longer in the summer, thus increasing their chances of supporting streamflow downslope (Burrell & Anderson 1991, Morley et al. 2011). Wetlands are typically ground water discharge areas where they occur at the toe of much steeper slopes (Crabtree & Burt 1983) or at geologic faults (Stein et al. 2004).	Groundw2_
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.85	Wetlands that contribute to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow that is affected by wetlands there is likely to be greater than in lowlands.	ShedPos2
	Function Scores	Function Score for Invertebrates				0.70	Summer streamflow is critical to supporting this group's productivity and diversity.	InvScore2
		Function Score for Anadromous Fish Habitat				0.46	Summer streamflow is critical to supporting this group's productivity and diversity.	AnadScore2
		Function Score for Non-anadromous Fish Habitat				0.40	Summer streamflow is critical to supporting this group's productivity and diversity.	ResFish Score2

Connectivity	1.00	OutDur	ConnectivLF
Surface Storage	0.32	AVERAGE(Aspect, Depth, Soil)	ClimateLF
Groundwater Input	0.25	AVERAGE(Groundw, Wettype)	GpC_2

Function Score for Low Flow Augmentation	F	2.72	OutDur * [(2*GroundwaterInput + SurfaceStorage)/ 3]
Benefits Score for Low Flow Augmentation	B	6.84	AVERAGE[ShedPos, AVERAGE(InvScore, AnadScore, ResFishScore)]

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Water Cooling		The effectiveness for maintaining or reducing temperature of downslope waters.	WC					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	North-facing wetlands are likely to be more shaded and thus cooler and more capable of contributing cool water to downslope water bodies.	Aspect7
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	0	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	When water remains entirely belowground, water temperatures in summer remain cooler than if exposed aboveground.	SatPct7
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	1	2	2			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				1.00	Shade from vegetation and other features is an important factor in cooling surface water and runoff before it reaches water bodies farther downstream (e.g., Rounds 2007). A study of many Seattle-area wetlands found that summertime temperatures ranged higher in wetlands that were characterised by relatively large open pools that lacked shade (Reinelt & Horner 1990). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if water is present only seasonally.	Shade7
		<5% of the water is shaded, or no surface water is present then.	0	0	0			
		5-25% of the water is shaded.	0	1	0			
		25-50% of the water is shaded.	0	2	0			
		50-75% of the water is shaded.	0	3	0			
		>75% of the water is shaded.	1	4	4			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.17	Wetlands with greater water depth overall tend to have cooler outflows (depending on elevation of the outlet) because water depth provides insulation from solar warming. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth7
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	6	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Where most of the surface water is ponded, it is more likely to be heated by the sun than if distributed in the channels or residing underground. *This indicator is used only if some persistent surface water is present in the AA. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry7
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Ponded water that is open and unvegetated it is more likely to be heated by the sun. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	OpenPonded
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater discharging into wetlands supports a wetland's capacity to cool surface runoff during summer, because groundwater in most cases is cooler than surface water during that time (Mellina et al. 2002). In this region, cooler stream temperatures are associated with a greater proportion of groundwater-discharging wetlands in stream headwaters (Monk et al. 2013).	Gwater7
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.85	Wetlands that contribute cooler water to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow (and thus their temperature) that is affected by wetlands there is likely to be greater than in lowlands.	ShedPos7
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need to cool surface waters is likely to be greatest at locations where much of the contributing area is clearcut or paved, thus generating warmer inputs to streams.	Imperv7
		<10%.	1	0	0			
		10 to 25%.	0	2	0			
		>25%.	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	The need to cool surface waters is likely to be greatest where streams are south-facing and thus are exposed longer each day to warming sunlight. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its apparent contributing area.*	Aspect7v
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	0	2	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	The need to cool surface waters is likely to be greatest at locations that are the region's warmest.	Warmth7
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Wetlands that are narrower than the channel, lake, or estuary they adjoin are likely to have much less effect on water temperature in those receiving waters.	Fringe7b
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Wetlands that have no outflow are likely to have only minimal effect on temperature of other water bodies.	OutDur7
		Persistent (surface water flows out for >9 months/year).	1	5	5			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	0			0.00	Unshaded input streams provide more opportunity for wetlands to cool the water. Streams whose contributing areas have a greater extent of roads (road density) have higher temperatures. A study of 104 streams in British Columbia found there is a 6-in-10 chance that the summer maximum weekly average water temperature will increase by 2.3 degrees F if road density in the contributing area exceeds 27 ft of road per acre and by 5.8 degrees F if road density exceeds 53 ft of road per acre (Nelitz et al. 2007). However, overall vegetation patterns in a watershed frequently have an equal or greater influence on stream temperature and aquatic productivity than vegetation just within buffer areas adjoining a stream (Brosofske et al. 1997, Sridhar et al. 2004, Stephenson & Morin 2009). One study found that maximum air temperature within a 100-ft wooded buffer was only slightly cooler than in a 16-ft wide wooded buffer (Meleason & Quinn 2004). Vegetated buffers along north-south streams in British Columbia are more effective than those oriented east-west (Gomi et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland has no input tributary.*	ShadeIn7
	Function Score for Anadromous Fish					0.46	Anadromous fish in this region are highly sensitive to warm temperatures, so wetlands that cool or maintain natural water temperatures could be considered more valuable.	AnadFish7

Function Score for Water Cooling	F	5.13	IF((AllSat1=1), Gwater, ELSE: AVERAGE(Gwater, Shade, OpenPonded, Depth, ISOdry, SatPct)))
Benefit Score for Water Cooling	B	3.76	IF(Fringe=1), 0, OutDur X [AVERAGE(ShadeIn, ShedPos, Aspect, Imperv, Warmth) + AnadFish] /2

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Sediment Retention & Stabilisation	The effectiveness for intercepting and filtering suspended inorganic sediments, thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilising underlying sediments or soil.	SR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981). Here, wetland area is used as a surrogate for wetland volume.	WetPctCA2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Longer flow paths within a wetland allow more time and opportunity for suspended sediments to be deposited.	FlowDist2
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, and thus deposition of sediment suspended in runoff, is potentially greater in areas where water and soils do not remain frozen for long periods. Wetlands tend to be ice-covered for shorter duration, thus reducing the erosion of sediment from their shorelines as a result of ice scour. Mean annual temperature is one indicator of the likelihood of this condition.	GDD2
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to water flow, promoting sedimentation of suspended particles, as well as reducing the resuspension of bottom sediments by waves and currents.	Gcover2
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	5	5			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	2	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more sedimentation to occur, although usually only to a minor degree.	Girreg2
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	As a wetland's surface water area expands seasonally, water velocity is often reduced due to increased friction, and material suspended in the expanding water body is more likely to be deposited. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct2
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.50	Suspended sediment is more likely to be filtered and stranded in vegetation if water levels fluctuate. However, in some soil types, large water level fluctuations cause erosion that results in more sediment being exported than retained. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if surface water is permanent (i.e., must have at least a seasonal-only zone in order to have water fluctuation).*	Fluc2
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper waters usually imply slower water velocity, longer water detention time, more space for storing deposited sediments over time, and reduced likelihood of deposited sediments being resuspended by wind mixing or currents (Evans & Rigler 1983, Nolen et al. 1985). However, vegetation density is usually greater in shallow wetlands, providing other opportunities to filter and stabilize (with roots systems) suspended sediments. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthC2
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding allows more time for suspended sediment to settle out. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Ponding2
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					As the proportionate area of emergent and other aquatic plants increases, current velocity may be reduced (depending on the distribution of the plants relative to flow paths), and a larger proportion of the sediment may be intercepted, particularly if the wetland is not narrow. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov2
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.57	Wider vegetated areas provide more area for sediment particles borne in runoff to be filtered and deposited. Knutson et al. (1981) found that emergent wetlands wider than 30 feet reduced wave energy by 88% while those less than 6 feet wide were relatively ineffective in wave buffering. Many studies have shown that sediment retention is greatest in the first 5-20 ft of a buffer, that is, the most uphill portion, which is closest to potential inputs of runoff-borne sediment (Polyakov et al. 2005, White et al. 2007). However, this depends on steepness of the terrain, erodibility and infiltration capacity of the soil, ground cover, antecedent soil saturation, sediment particle size, and runoff intensity. Wider buffers are required when runoff carries finer-sized particles (e.g., clay). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthAbs2
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	4	4			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	Wetlands whose shorelines have gentle slope are more likely than those with steep ones to retain sediment runoff from adjoining uplands, and are likely to have more vegetation that facilitates this. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	WatEdge Slope2
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation should allow more contact between plants and moving sediment-bearing water, resulting in greater deposition of suspended sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if there is no ponded water, or if ponded water but no vegetation, or if ponded but no open water.*	Interspers2
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain all sediment that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less sediment annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDur2
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for suspended sediments to be deposited. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of sediment (Amatya et al. 2003). *In calculations, is excluded automatically (cell goes blank) if no outlet. In calculations, is excluded automatically (cell goes blank) if wetland has no surface water outlet.*	Constric2
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus sedimentation, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment to be deposited. The sinuosity is as much the result of sedimentation-erosion dynamics as it is the cause of them. Wetlands with a sheet flow pattern often retain more suspended solids than channelised systems because interception and resistance is greater (Morris et al. 1981). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.	ThruFlo2
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	3	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	6	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	4	4			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50		Gradient2
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.50			0.50	If soil or sediment within a wetland is eroding, the wetland is unlikely to be trapping incoming suspended sediment. *In calculations, is ignored (cell goes blank) if wetland soil is currently intact, but is scored as a negative if disturbance is occurring.*	

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive sediment from upslope is entering a wetland, this provides more opportunity for the wetland to trap sediment and associated metals and hydrocarbons. This increases the value of any retention capacity that the wetland provides. High levels of incoming suspended sediment often correspond with high levels of other pollutants.	ToxUp2
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	ToxData2
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Wetlands with large contributing areas are likely to receive more suspended sediment and thus have more opportunity to trap sediment, which potentially increases their value as protectors of downstream water quality.	CApct2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) sediment-trapping capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, as occurs when much of the contributing area contains unvegetated surface. However, a study in Alaska that compared total sediment yield in channels surrounded by old-growth, clear cut, and young alder found no significant difference in sediment yield (Gomi & Sidle 2003). In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.	ImpervPctSS
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) sediment retention that potentially could be provided by wetlands is greater when upland sediment loads are not being retained or rerouted by features closer to the sediment source. If runoff is diverted away from downslope wetlands, such as in road ditches or drainage tile, then those wetlands will become drier. When they do, they will have less opportunity to receive water with suspended solids (Wigington et al. 2005, Hogan & Walbridge 2007). Even when runoff is not diverted from the wetlands, if the volume of runoff entering a wetland per unit time increases, the wetland will be less effective in treating the runoff. That is because increased runoff will often cause tiny channels to develop within the wetland, or will increase the dimensions of existing ones. These factors will decrease the detention time and pollutant contact with vegetation, because most of the vegetation will be positioned apart from the water flowing through in the small channels (McBride & Booth 2005, Alberti et al. 2007). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	TransportSS
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.00	There is more opportunity for suspended sediments to be trapped by a wetland (and thus more value to this function) if the wetland contains surface water which facilitates transport of suspended sediment. into the wetland.	SatPct2
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	6	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	1	4	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2				
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Large water level fluctuations pose the possibility of increased shoreline erosion, which can be partly alleviated by wetlands, thus making those wetlands more valuable as shoreline stabilizers.	MaxFluc2
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Used as a classifier.	Inflo2
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of sediment. Their sediment-trapping role could thus be considered to be more essential and valuable than if vegetated buffers were adequate to perform the same function.	CAnatPct2
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	1	2	2			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Increased slope in a watershed or buffer strip results in more erosion and greater transport of soil particles to downslope wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), and Nieswand et al. (1990). Sediment export from sloping lands mostly begins at about 10% slope and increases as slope becomes steeper (Zhang et al. 2010). Greater sediment loads associated with steeper slopes increase the opportunity for wetlands to trap that sediment, thus increasing their value in protecting waters further downslope. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area or the last choice was selected in the previous question.*	BuffSlope2
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	4	4			
		>30%.	0	6	0			
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.08			0.08	Because actual data on sediment loads are lacking for many wetland watersheds, this approximation is included as well, and is based on a host of activities known in some cases to contribute excessive sediment, e.g., wetland ditching (Pavey et al. 2007).	Erodible2

Live Store	0.50	IF(AllSat1=1),"", AVERAGE(Fluctua, SeasPct)	LiveStore2
Entrain	0.43	IF(AllSat1=1),"", AVERAGE(OutDura, FlowDist, Depth, Ponding, Constric, WatEdgeSlope)	Entrain
Dry Intercept	0.67	AVERAGE[Gradient, WetPctCA, AVERAGE(Girreg, Gcover, SoilDisturb)]	DryIntercept
Wet Intercept		IF(AllSat1=1),"", IF(NoPonded=1),"", ELSE: AVERAGE (Width, AVERAGE(GDD, Thruflo, AqPlantCov, Interspers))	WetIntercept

Function Score for Sediment Retention & Stabilization	F	5.31	(IF((AllSat1=1), DryIntercept, IF((NoOutlet=1), 1, (2*AVERAGE(Entrain, LiveStore2) + AVERAGE(DryIntercept, WetIntercept))/3)))
Benefits Score for Sediment Retention & Stabilization	B	4.28	MAX(ToxData, ToxUp, AVERAGE(Inflo, SatPct, AVERAGE(ImpervPctSS, ErodibleSS, CAnatPct, BuffSlope, CApct, TransportSS, MaxFluc)

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Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season) as a result of chemical adsorption, or from translocation by plants to belowground zones with less potential for physically or chemically remobilizing phosphorus into the water column.	PR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition (and P-retention, which sometimes correlates with that) increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981).	CApctB3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Phosphorus retention often correlates with detention time, which in turn correlates with flow path length within a wetland.	FlowDist3
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, which enhances deposition of sediment-bound P, is potentially greater in areas where water and soils do not remain frozen for long periods. However, cold temperatures slow the decomposition of plant material and increase the retention of P in accumulating peat.	GDD3
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to runoff, promoting sedimentation of suspended particles and reducing erosion. This promotes phosphorus retention because phosphorus is typically adsorbed to soil particles.	Gcover3
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more deposition of phosphorus-containing suspended sediments to occur, although usually only to a minor degree.	Girreg3
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.60	Long-term retention of phosphorus can occur when soil or sediment contains high concentrations of aluminum or iron, mainly at low pH (Richardson et al. 1985), and to a lesser extent, calcium at higher pH (Bridgham et al. 1996). Aluminum occurs most commonly in organic and clay soils. Phosphorus is also retained in wetlands via plant uptake, but in organic soils, acidic conditions can inhibit plant capacity to take up and retain phosphorus (Prescott et al. 2000) and in most cases, this represents only a temporary retention..	SoilTex3
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	3	3			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Lacustrine wetlands are more likely than bogs or fens to be phosphorus-limited (Walbridge & Navaratnam 2006), and thus should be more able to take up and retain	Lake3
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Sites that remain continually moist (saturated) but not flooded may be more likely to retain phosphorus (Aldous et al. 2007).	SatPct3
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	1	2	2			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	In some cases, sediments that remain covered with water year-round (and longer) tend to become anaerobic and release phosphorus, especially in deeper wetlands. Thus, wetlands with the least extent of persistent water may be most retentive of whatever P they receive. On the other hand, seasonal drawdowns can mobilize phosphorus that has accumulated in sediments (Snyder & Morace 1997, Aldous et al. 2005). To a perhaps lesser extent, reflooding of soils that have been dry for extended periods also can mobilize phosphorus, especially if flooding creates anoxic conditions (Burley et al. 2001), or if large quantities of leaf litter and other organic matter are present and rapidly decompose or leach phosphorus. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Persis3
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Wetting and drying of sediments, as happens especially in wetlands with large water level fluctuations, increases the leaching and desorption of phosphorus from sediment organic matter, thus resulting in net export. However, stable water levels also can promote phosphorus export (not retention) because they are often associated with anoxic conditions that result in increased mobility of phosphorus. Sediment P release and subsequent export is particularly strong during periods of seasonal anoxia (Burley et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu3
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper wetlands are more likely to experience anoxic conditions that promote P mobility and export. However, deeper waters also imply slower water velocity, longer water detention time, more time for biological processing of phosphorus, and reduced likelihood of phosphorus associated with deposited sediments being resuspended by wind mixing or currents. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DomDepth3
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	5	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up phosphorus from sediments (and some, from the water directly) and can facilitate long-term retention if P is transferred to roots that are not as subject as the foliage is to leaching the nutrients back into the water column. Plants also facilitate sediment deposition by slowing the water, and much phosphorus is adsorbed on that sediment so is also deposited and potentially retained. However, their decaying foliage also frequently creates anoxic conditions that promote P release from sediments, if iron concentrations are low and aeration by currents and wind is poor (as tends to occur when emergent and submersed aquatic plants occupy most of a water body). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov3
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	4	0			
		70-99% of the ponded water.	0	3	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.57	Wider vegetated areas provide more area for phosphorus adsorbed to sediment particles in runoff to be filtered and deposited. Where phosphorus is mainly attached to sediment (as often it is), then buffer widths sufficient for sediment retention (generally 10-30 ft) may be almost as effective for retaining phosphorus (White et al. 2007). But if phosphorus is mostly in dissolved form (orthophosphate, or soluble reactive phosphorus), then vegetated buffers may need to be very large or may not be effective at all (Prepas et al. 2001, Hoffman et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VegWabs3
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	4	4			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater sediment and phosphorus removal. That is because plants assist the deposition of suspended sediment which contains P, while open water areas tend to be more aerobic which immobilizes P in the deposited sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, or if ponded but no open water.*	Interspers3
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				A proliferation of algae and floating aquatics can indicate that the wetland is receiving more nutrients than it is capable of processing effectively. These non-rooted plants do not oxygenate the sediments, they take up and store nutrients only briefly, and their die-offs create anoxic conditions that mobilize phosphorus temporarily retained in sediments. In the calculations, abundant algae reduces the score but absence of blooms does not increase it. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Algae3
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain all phosphorus that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less phosphorus annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura3
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for sediments to be deposited and phosphorus to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of phosphorus (Amatya et al. 2003).	Constric3
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.75	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow phosphorus adsorbed to sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus may be more effective at allowing sediment to be deposited, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the phosphorus associated with it to be deposited. Wetlands with a sheet flow pattern often retain more total phosphorus than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo3
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	3	3			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:					Acidic conditions (indicated by staining) potentially support greater adsorption of P by iron and aluminum (Richardson et al. 1996, Sutmm & Morgan 1996) and that is often associated with the dissolved organics that cause staining (Gorham et al. 1998). Acidic conditions also slow the decomposition of plant material, thus increasing P storage in peat. P retention can also occur at high pH as a result of precipitation with calcium. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.* *Otherwise, retention is assumed to increase below a pH of 5 or above a pH of 9.*	Stain3
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.75	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the phosphorus that is associated with it. Ground cover becomes more important to sediment stabilization in wetlands on slopes.	Gradient3
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	3	3			
		6-10%.	0	2	0			
		>10%.	0	0	0			
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0			0.00	P retention is expected to be considerable in calcareous fens because soluble P is precipitated by calcium when pH is basic, and those conditions typify calcareous fens..	CalcFen3

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardize	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive phosphorus from upslope is entering a wetland, this provides more opportunity for the wetland to retain P and thus increases the value of any P-retention that the wetland provides. High P levels often correspond with high levels of other pollutants.	PsampUp3
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	PsampDown3
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Phosphorus commonly adsorbs to suspended sediment, and wetlands that comprise a large proportion of their contributing area are more effective for retaining sediment in runoff, and thus phosphorus.	CApct3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) phosphorus retention capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and associated P. This occurs when much of the contributing area contains impervious surface. Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of phosphorus. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 40% more phosphorus to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	ImpervCA3
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) phosphorus retention that potentially could be provided by wetlands is greater when upland phosphorus loads are not being retained by features closer to the phosphorus source. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	Transport3
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of sediment and adsorbed phosphorus, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflo3
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of P are commonly associated with higher levels of conductivity and TDS. Higher P concentrations indicate more opportunity for the wetland to retain P, thus making its provision of this service more valuable to downstream waters. In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. In calculations, is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.	Conduc3
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater in many areas is phosphorus-rich, especially when associated with iron-rich bedrock. This increases the opportunity of the receiving wetlands to process the P, thus increasing the importance (value) of their role in the local ecosystem.	Groundw3
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Riparian buffers (in contrast to vegetation and other features located far from streams) can be responsible for up to 70% of the reduction in nutrient loads to streams (Diebel et al. 2009, Roberts & Prince 2010), so a lack of an adequate buffer increases the opportunity (and thus value) for a wetland to process nutrients.. However, many factors other than buffers control a wetland's water quality. These include underlying soils and geology, groundwater discharge or recharge rates, topography, plants and animals within a wetland, and proximity to the ocean (Feller 2005).	NatCApct3
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	1	2	2			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Wetlands that receive suspended sediment in runoff from steep slopes are more likely to retain it because of the large differential in current velocities, which promotes deposition in the wetland. This increases the opportunity of the wetlands to process the P, thus increasing the importance (value) of their role in protecting downslope waters from overenrichment. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	BuffSlope3
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	3	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	1			0.56	Because actual data on phosphorus loads are lacking for many wetland watersheds, this approximation based on a host of phosphorus-generating activities is included as well.	Pload3

Frozen Duration	0.13	GDD	FreezeDura3
Intercept Dry	0.71	AVERAGE(Gradient, FlowDist, AVERAGE(Girreg, Gcover, CApctB))	IntercepDry3
Intercept Wet		IF(AllSat1=1),"", IF(NoPonded=1),"", AVERAGE (Width, MAX(Thruflo, AqPlantCov, Interspers))	IntercepWet3
Connectivity	0.38	AVERAGE(OutDur, Constric, Gradient, FlowDist, Lake)	Connec3
Adsorption	0.30	AVERAGE(SoilTex, Stain, CalcFen)	Adsorb3
Desorption	0.55	AVERAGE(SatPct, Persis, DomDepth, Fluctu)	Desorb3

Function Score for Phosphorus Retention	F	4.12	IF((AllSat1=1), AVERAGE(IntercepDry, Adsorb, FreezeDura), IF((NoOut=1), 1, ELSE: (3*AVERAGE(Adsorption, Desorption) + 2*Connectivity+ (AVERAGE(InterceptWet, InterceptDry) + FreezeDuration) / 7
Benefits Score for Phosphorus Retention	B	6.25	[MAX(Pload, PsampUp, PsampDown, AVERAGE((Inflo, AVERAGE(BuffSlope, CApct, Transport, Groundw, ImpervCA, NatCApct))

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Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas, primarily through the microbial process of denitrification, while generating little or no nitrous oxide (a potent greenhouse gas).	NR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF16	Upland Edge Contact	Select one:				1.00	Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, proportionally longer (i.e., convoluted) edges should provide the most opportunity for removal of nitrate via denitrification.	UpEdge Shape4
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	1	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	4	4			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.85	A disproportionate amount of the nitrate introduced to a watershed is processed in headwater areas rather than in downstream lowland areas (Krause 1982). However, where headwaters are at regionally high altitudes, the cooler temperatures and shorter growing seasons can potentially restrain denitrification.	Elev4
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Where a wetland comprises a large proportion of its catchment, nutrient loading is more likely to occur at rates and levels that can be processed effectively.	WetPctCA4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	Soil temperatures are warmer for longer on south-facing slopes, and this is essential for denitrification which removes soluble N (Kim et al. 2007). However, those soils should not be dried out to less than 70% saturation by those warmer conditions (Hefting et al. 2006).	Aspect4
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	0	2	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	N removal often correlates with detention time, which in turn correlates with flow path length within a wetland.	FloDist4
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Microbes responsible for most of the nitrate removal in wetlands thrive best at warmer soil or sediment temperatures. In contrast, freeze-thaw cycles in wetlands are often characterized by change from aerobic to anaerobic conditions, which can mobilize nitrate in sediments, making the nitrate vulnerable to being exported downstream. Also, wetlands that are frozen for long periods are generally in regions with shorter growing seasons, resulting in less opportunity for biological uptake of nitrate.	Warmth4
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Floodplain wetlands are notably effective for removing N via denitrification and that process is limited by available carbon more than it is in bogs (Pinay et al. 2003). Bogs are typically nitrogen-poor (Heilman 1966) and thus are able to rapidly take up much of the nitrate that reaches them. Their acidic conditions inhibit generation of nitrous oxide as well as inhibiting nitrification (Dammann 1988) and the removal of nitrate via denitrification (Pinay et al. 2003). Denitrification is more prominent in fens and marshes than in acidic bogs. Bogs tend to cycle nitrogen internally and remove added N (Li & Vitt 1997, Bayley & Mewhort 2004), although due to acidic conditions and other factors, mosses in some wetlands have less capacity to take up apparently available N than do vascular plants (Heijmans et al. 2002, Berendse et al. 2001). Forested wetlands, especially those with an alder component or on slopes, may have less capacity to remove N via denitrification and may actually add nitrate via N fixation (Fellman & D'Amore 2007).	Wettype4
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	1	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.16667			0.17	Denitrification may be less under evergreen canopies than under deciduous because of the more shaded (cooler) microclimate and acidic soil conditions of the former.	WoodyTyp4
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Less canopy cover increases soil warming in spring which could accelerate denitrification, a major process for removing nitrate. However, tree roots can extend the subsurface zone of denitrification by oxidizing deeper subsurface areas. Trees also take up and temporarily retain nitrate, as well as adding carbon to the soil, which promotes denitrification. Therefore, a balanced interspersed mix of shading woody and non-shading herbaceous vegetation is hypothesized to enhance N removal.	TreeCanop4
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to runoff, promoting deposition of organic nitrogen and resisting erosion of N-containing sediments. Vegetation takes up nitrate at least seasonally and plant roots can promote denitrification by providing a carbon source (Lin et al. 2002) and oxidizing otherwise anoxic subsurface soils (Brix 1994). However, shade from plants reduces soil temperature which slows the denitrification rate (Hogg & Lieffers 1991), and emissions of harmful nitrous oxide can be greater in wetlands with denser vegetation.	Gcover4
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more biological processing and deposition of nitrate-containing suspended sediments, although usually only to a minor degree. The presence of soil cracks implies a potential downward extension of the aerobic zone, interspersing it with anaerobic areas, which should lead to greater denitrification. Studies of wastewater treatment wetlands have shown greater nitrate removal where pockets of deeper water are interspersed with shallower areas (i.e., diverse microtopography).	Girreg4
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	2	0			
		Several (extensive micro-topography).	1	3	3			
F13	Upland Inclusions	Within the AA, inclusions of upland are:				0.50	Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, if inclusions of aerobic non-wetland soils are numerous and interspersed throughout a wetland, the extent of denitrification overall should be greater.	Inclus4
		Few or none.	0	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	1	1	1			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.75	Denitrification rates are often limited by the amount of available carbon (Groffman et al. 2009, Capps et al. 2014). Organic soils have the most carbon, and coarse soils usually have the least. Denitrification enzyme activity, on a per gram basis, is typically greater in organic soils than mineral soils (Van Hoewyk et al. 2000). However, the acidic nature of many organic soils can limit denitrification, the major process for nitrate removal. Soils having less than 65% silt and clay have very limited capacity to remove nitrate via denitrification (Pinay et al. 2003). Emissions of nitrous oxide (a detrimental greenhouse gas) are most likely to occur in soils that are poor in organic matter but rich in nitrogen (e.g., the carbon-nitrogen ratio is less than 25, Hunt et al. 2007). The 40 cm threshold represents a frequent transition zone in some soil types from aerobic to anaerobic conditions; in other soils the transition occurs at about 25 cm	SoilTex4
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	4	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	3	3			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	0	3	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.67	Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008) .	SatPct4
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	1	4	4			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Exposing sediments to the air can speed decomposition and cause them to release accumulated nitrate, potentially resulting in less removal. In contrast, long-duration flooding makes sediments anaerobic, which is necessary for the denitrification process (Westermann & Ahring 1987). Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct4
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	Denitrification rates are higher in vernal pools and other areas with that are inundated only seasonally, as compared with drier upland forests (Capps et al. 2014). Denitrification occurs at the interface between aerobic and anaerobic conditions, and such conditions often develop where a ponded area expands seasonally into vegetated areas. In addition, levels of soil organic matter are often higher in seasonal wetlands than in permanently inundated ones of comparable extent (Shaffer & Ernst 1999), and organic matter is key to supporting denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average*	SeasWpct4
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	4	0			
		>95% of the AA.	0	3	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Wetting and drying of sediments, as happens especially in wetlands with large and frequent water level fluctuations (because a wider area is subject to wetting-drying and associated aerobic-anaerobic shift), increases the loss of nitrate via denitrification (Groffman & Hanson 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu4
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponded conditions provide longer time for nitrate processing, as well as causing sediments to lose oxygen, thus creating a microclimate favorable for denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondPct4
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up nitrate from sediments and can facilitate retention if N is transferred to roots not as subject to erosion as foliage. Plants also facilitate sediment deposition by slowing the water, and some nitrate is associated with that sediment so is also deposited and potentially retained. Perhaps most importantly, roots of some plants oxidize the anoxic sediments that surround them and this facilitates denitrification, the major process for removing soluble nitrate from water. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov4
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider vegetated areas provide more area for biological processing of nitrate, and for nitrate adsorbed to sediment particles in runoff to be filtered and deposited. The most comprehensive and sophisticated analysis that used statistical procedures (meta-analysis) to synthesize results from over 60 peer-reviewed studies of nitrate removal by buffers in temperate climates found that widths of approximately 10 ft, 92 ft, and 367 ft are needed to achieve 50%, 75%, and 90% removal efficiencies for nitrate (Mayer et al. 2005, Mayer et al. 2007). This assumed that most inputs are through subsurface flow. When surface flow dominates (as often occurs during storms, and where subsurface storm drains have been installed around homes), buffers of 109 ft, 387 ft, and 810 ft are needed to achieve the same removal efficiencies (Mayer et al. 2005). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs4
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater nitrate removal. That is because open water areas tend to be more aerobic, whereas densely vegetated areas often are anaerobic, except where plant roots oxidize a small part of the sediment. The combination of anaerobic and aerobic areas in close proximity facilitates nitrate loss through denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers4
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain or remove all nitrate that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less nitrate annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura4
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for nitrate to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric4
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.75	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow more time for biological processing of nitrate. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the nitrate associated with it to be deposited. Increased channel complexity also implies greater interspersion of open water and vegetation (see above) and in some cases, more hyporheic flow -- both of which favor nitrate removal. Wetlands with a sheet flow pattern often retain more nitrate than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo4
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	3	3			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	pH is a strong predictor of denitrification in wetlands (Morse et al. 2012). Other factors being equal, the optimal pH for denitrification is 7 to 8.5, whereas a sharp decline occurs at a pH of less than 6 or greater than 8.5 (Simek & Cooper 2002). Acidifying Sphagnum mosses are most common below a pH of 5.5 (Vitt 2006). *In calculations, is excluded automatically (cell goes blank) if last choice selected and is set to 0.5 if second choice is selected. If pH is 6.0-8.5, score is set to 1, while outside this range is 0 This formula recognizes diminished rate of denitrification as pH becomes more acidic or basic.*	Acid4
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Many studies have highlighted the importance of subsurface (hyporheic) flow, or groundwater discharge, to denitrification rates in both riverine and non-riverine (e.g., Kroeger & Charette 2008) wetlands. Groundwater in many regions is iron-rich, and addition or removal of nitrate can significantly affect the ecological mobility of iron and perhaps some other metals in wetland soils (Shrestha et al. 2011).	Groundw4
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the nitrate that is associated with it, and also supporting anaerobic conditions that lead to more nitrate removal via denitrification. Steeper gradients in a wetland imply greater potential for outflow and transport downslope, and more aerobic conditions.	Gradient4
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Constructed (and some restored) wetlands typically have lower soil organic matter (Shaffer & Ernst 1999), and that deficit limits the denitrification that otherwise removes nitrate. Thus, new wetlands would be expected to release the more nitrate to downstream waters. However, the proportion of incoming nitrate that is exported in some cases is greater in soils that are more fertile, i.e., nearing nitrate saturation, with a C:N ratio lower than 25 (e.g., Gundersen et al. 2006).	NewWet
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	0.50			0.50	Soil compaction seals up pores in the soil that serve as habitat space for denitrifying bacteria, as well as causing a larger proportion of the precipitation to leave as runoff rather than infiltrate into subsurface areas where denitrification is greatest. Soil erosion often results in loss of carbon-rich upper soil layers that are important to denitrification.	SoilDisturb4

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.40	Population centers, even when they do not drain into wetlands, can provide wetlands with more opportunity to remove N because population centers often generate more airborne N as a result of greater vehicle traffic, and this enters wetlands as N deposition.	PopDist4
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	1	2	2			
		1 - 5 km.	0	1	0			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Vehicle emissions contain substantial N products, so road traffic often results in increased nitrogen deposition in wetlands. This increases the opportunity for N-removal, and thus the value of a wetland's capacity for N removal. Also, N removal efficiency increases exponentially with N deposition (especially when deposition is 0.25 to 0.50 g of N per year (Bragazza et al. 2004).	RdDist4
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0			0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	GWsens
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive nitrate from upslope is entering a wetland, this provides more opportunity for the wetland to remove N and thus increases the value of any N-retention that the wetland provides. High nitrate levels often correspond with high levels of other pollutants.	NsampUp
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	NsampDown
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	See the above. This indicator is highly correlated to it but is not identical.	Capct4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) nitrate removal capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and nitrate from other sources, as occurs when much of the contributing area contains impervious surface.	Imperv4
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) nitrate removal that potentially could be provided by wetlands is greater when upland nitrate loads are not being retained by features closer to the nitrate source. Vegetated buffers are more effective in protecting the quality of wetlands when most water enters the wetland as shallow subsurface lateral flow or discharging groundwater, rather than channel flow or surface runoff (Dillaha et al. 1989, Dosskey et al. 2001, Wigington et al. 2003, Mayer et al. 2005). Buffers in rural New York were found to be ineffective when crossed by small unmapped drainageways (e.g., roadside ditches) that were not buffered but were connected to pollution sources (Madden et al. 2007).	Transport4
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Total available nitrogen in soil increases with increasing density of nitrogen-fixers such as red alder (Sanborn et al. 2002, Cortini & Comeau 2008). Consequently, wetland contributing areas with a large proportion of alder often export more nitrate to wetlands (Compton et al. 2003, Cairns & Lajtha 2005, Shaftel et al. 2012, Greathouse et al. 2014). Because this provides wetlands with increased opportunity to process the N, it increases the value of their role in the local ecosystem.	Nfix4
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of nitrate from upland sources into wetlands, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflow4a
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of N are commonly associated with higher levels of conductivity and TDS. Higher N concentrations indicate more opportunity for the wetland to remove N, thus making its provision of this service more valuable to downstream waters. *In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.*	Conduc4
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter	0					
		Neither of above	0					
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Other factors being equal, wetlands surrounded by little natural cover tend to receive higher loads of nitrate. Their nitrate removal role could thus be considered to be more essential and valuable for protecting waters further downstream. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 54% more nitrate to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009).	CAnatPct4
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	1	2	2			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	Pavement and other impervious surfaces facilitate transport of N-bearing runoff into downslope wetlands, thus increasing opportunities for N-removal. Increased opportunity translates into increased value of the wetland's N-removal service.	BuffCovTyp4
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Increased slope in a watershed or buffer strip has been linked to increased delivery of sediment and sometimes nitrate to downgradient streams and wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), Nieswand et al. (1990). However, an Ontario study found the slope of the contributing area had relatively little effect on concentrations of nitrate and carbon in a downslope riparian area. Soil carbon was more responsible for increasing nitrate removal, and soil carbon was actually greater on steeper slopes in that study area (Hazlett et al. 2008).	BuffSlope4
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	3	0			
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:				0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	Aquifer4
		Within 0-100 m. of the AA.	0	2	0			
		100-500 m. away.	0	1	0			
		>500 m. away, or no information.	1	0	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	1			0.56	Because actual data on nitrate loads are lacking for many wetland watersheds, this approximation based on a host of N-generating activities is included as well.	Nsource4

Warmth	0.29	AVERAGE[(AVERAGE(WoodyTyp, TreeCanop, Groundw), AVERAGE(Warmth, Aspect)]	FrozDura4
Interception and/or Erosion Resistance	0.62	AVERAGE(PondPct, Width, FloDist, Gcover, Thruflo, Interspers, Elev, WetPctCA)	Intercep4
Connectivity	0.39	AVERAGE(OutDur, Gradient, Constric)	Connec4
Organic	0.73	AVERAGE(Acid, SoilTex, WetType, NewWetland, AqPlantCov, SoilDisturb)	Organic4
Redox	0.60	(AVERAGE(SatPct, Persis, SeasPct) + AVERAGE(Fluctu, UpEdgeShape, Inclusions, Girreg))/2	Redox4

Function Score for Nitrate Removal	F	5.26	IF((NoOutlet=1), 1, IF((AllSat1=1), (2*Connec + Intercep + FrozDur + Organic + Redox)/6, ELSE: (3*Redox + 2*Connec + FrozDur + Organic + Intercep)/ 8)))
Benefits Score for Nitrate Removal	B	10.00	MAX[Aquifer, GWsens, Inflo, MAX(NSource, NsampUp, NsampDown, Nfix), AVERAGE(Imperv, RdDist, PopDist), AVERAGE(CAnatPct, BuffSlope, BuffCovTyp, Transport)]

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Carbon Sequestration	The effectiveness for retaining both incoming particulate and dissolved carbon, and through the photosynthetic process converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").	CS					

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetland emissions of methane increase with warming temperatures (Moosavi et al. 1994, Sha et al. 2011). Although plants responsible for much of the carbon sequestration in wetlands grow fastest at warmer soil or sediment temperatures, they also decompose faster. With colder temperatures (fewer degree days), the concentration of mobile DOC in forested wetland soils and streams decreases, suggesting more immobile carbon is sequestered onsite rather than being exported downslope in groundwater (D'Amore et al. 2010).	Warmth5
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Bogs have the deepest peat layers and thus more stored carbon than more fertile wetlands (fens) (Glenn et al. 2006). Methane emissions tend to be greater from fens, marshes, and other wetlands with water table near the ground surface for long periods (Liblik et al. 1997). Swamp soils may have greater releases of methane due to their greater diurnal fluctuations in water tables resulting from tree evapotranspiration. Methane emissions may be especially large from wetlands with emergent sedges (a common feature of fens) because they facilitate translocation of methane from sediments to the air (Hines et al. 2008).	Wettype5
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.67			0.67	Fixed carbon tends to cycle more rapidly in deciduous plant litter, thus supporting less sequestration. *In calculations, is excluded automatically (cell goes blank) if woody vegetation is absent. Otherwise, score is the reciprocal of the maximum deciduous cover among the 3 height classes, adjusted to a 0-1 scale.*	DecidTree5
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.40	Larger trees represent larger stores of sequestered carbon, but younger trees fix and accumulate carbon more rapidly (Anwar 2001, Ryan 2005). In New Brunswick, natural stands of sugar maple or yellow birch are believed to sequester the most carbon (Neilson et al. 2007). However, evergreen foliage from coniferous species tends to foster acidic conditions which slow the decomposition of organic matter (Collins and Kuehl 2001), thus leading to greater carbon sequestration. Acidic conditions and/or slowly-decomposing (recalcitrant) evergreen vegetation also can repress both methane generation (Valentine et al. 1994, Updegraff et al. 1995) and methane oxidation, but not necessarily CO_2 emissions (Bridgham & Richardson 2003). Carbon can be sequestered more effectively under such conditions (Blanco-Canqui & Lal 2004). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeForm5
		coniferous, 1-9 cm diameter and >1 m tall.	1	2	2			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	1	2	2			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	1	0			
		coniferous, >40 cm diameter.	0	2	0			
		broad-leaved deciduous >40 cm diameter.	0	1	0			
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:				0.40	Mosses contribute at least 48% of the productivity of some wetlands. Although the rate at which bogs store new carbon is relatively low, and because mosses decompose more slowly than woody and herbaceous plants, the peat layer in bogs and fens represents a considerable amount of carbon that already has been sequestered. Peat hummocks are particularly effective for sequestering carbon (Asada & Warner 2005). On a per unit area basis, bogs and other moss-covered areas generate less methane than many other wetlands (Hines et al. 2006, 2008),	MossCov5
		<5% of the vegetated part of the AA.	0	1	0			
		5-25% of the vegetated part of the AA.	1	2	2			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	The presence of peat or muck implies the presence (at least historically) of a microclimate favorable to long-term retention of particulate carbon. Peat is also a poor substrate for methanogenesis (White et al. 2008) but that is also true of well-oxygenated coarse soils (Grunfeld & Brix 1999). However, in very coarse soils the annual productivity of plants is often less than in clay/ loam soils because, unless the coarse soils are flooded regularly by rivers, they tend to be nutrient-poor. Moderately coarse soils (silts, loams), especially those with a large component of soil aggregates in the 2-8 mm range (Hossler & Bouchard 2000), tend to have neutral pH and support greater plant productivity and thus more soil organic carbon.	SoilTex5
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	4	0			
		Shallow Peat or organic <40 cm deep.	0	5	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F18	Sedge Cover	Sedges (Carex spp.) and cottongrass (Eriophorum spp.) occupy:				1.00	Among wetland plants, those best known for facilitating the emission of methane from sediments are sedge and cottongrass (Marinier et al. 2004, Strack et al. 2006, Green & Baird 2012). However, one study found methane production from cattail litter was almost 3 times greater than from sedge litter (Williams & Yavitt 2010), and alder also has been found to facilitate methane emissions from wetlands (Smialek et al. 2006, Gauci et al. 2010). *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous cover, or if cover is entirely forbs.*	Sedge5
		<5% of the vegetated area, or none.	1	3	3			
		5-50% of the vegetated area.	0	2	0			
		50-95% of the vegetated area.	0	1	0			
		>95% of the vegetated area.	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Accumulation of carbon as peat is fostered by persistently high water tables or flooded conditions, due to the anaerobic and acidic conditions which slow decay of organic matter (Belyea & Malmer 2004). However, persistently high water tables also increase carbon loss from emissions of methane (Glatzel et al. 2004, Keller et al. 2004, Pelletier et al. 2007, Altor & Mitsch 2008) and occasionally CO_2, although a Saskatchewan study found greater methane release from wetlands flooded for short periods each year than from those flooded semi-permanently (Pennock et al. 2010). Methane emissions in one study occurred mostly when water content of the soil exceeded 25% (Smith et al. 2000). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct5
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	At least in riverine wetlands, overall "average" methane emission from hydrologically pulsed sites may be less than that from sites where inundation is permanent (Mitsch et al. 2005, Altor & Mitsch 2008). Flooding from seasonally connected water bodies also promotes greater plant productivity, which provides more organic matter that potentially can be stored. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct5
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Very large water level fluctuations can reduce plant productivity and increase the release of methane. Maintaining steadily moist conditions (i.e., little or no water level fluctuation) may minimize methane releases (Tuittila et al. 2000, Price et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu5
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	Waters that are persistently deeper than 2 ft, and especially deeper than 6 ft, usually support much less vascular plant production which otherwise could be sequestered while acidifying the soil and thus dampening methane emissions. In a flooded pasture of wild hay, plant production declined if continual flooding exceeded 50 days at a depth of 7 inches (Rumberg & Sawyer 1965). On the other hand, methane emissions can decrease with increasing depth of surface water over the range of 0 to 1m depth (Pelletier et al. 2007, Cheng et al. 2007). One study found methane emissions were greater from a lake than a bog (Edwards et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth5
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.33	Annual plant productivity (and thus potentially-storable carbon) is often less in ponded wetlands than in wetlands where periodic water circulation replenishes nutrients (Thormann & Bayley 1997). Also, methane emissions may be higher in ponded areas because such areas are more likely to develop anaerobic conditions (Magenheimer et al. 1996, Tranvik et al. 2009). Aerobic conditions can increase the proportion of plant production that is allocated to belowground tissue, which benefits carbon storage because such tissue is more likely to resist erosion and be incorporated into longterm storage in soil. However, organic matter in ponded areas is less subject than organic matter in channels to being transported downslope in floodwaters or groundwater and thus could be more likely to become incorporated into soils, resulting in carbon being sequestered. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet5
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	1	1			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	2	0			
		>95% of the water.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants, especially those in acidic environments and/or with fibrous tissue, usually add more carbon to wetlands than they lose in the form of CO2 from decomposition. They also trap and deposit particulate carbon carried into a wetland from upslope. However, decomposition of the organic matter from plants in some wetlands generates methane. Methane emissions per unit area can be high in floating mats of vegetation (Moosavi et al. 1996) and in shallow areas with dense cover of vascular plants (Smith et al. 2000, Cheng et al. 2007) whose roots facilitate the movement of methane from soils to the surface, as compared with lower methane emissions in areas of open water (Rose & Crumpton 2006) or mats of submersed aquatic vegetation (Smith et al. 2000). Nonetheless, at least in restored wetlands, the net effect on carbon balance over a projected 33-year period is sequestration (Badiou 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov5
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider bands of vegetation represent more biomass to be sequestered, and are more effective in trapping organic matter carried to the wetland by upland runoff. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs5
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.30	Wetlands that lack outlets retain most carbon that enters them or is produced within. However, methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Wetlands that connect to downslope water bodies for only part of the year would be expected to export less carbon annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura5
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	6	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	8	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	10	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	10	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.67	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for scarbon in suspension to settle, although methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Ditching of some wetlands may reduce methane emissions in the long term but initially accelerates the decomposition and loss of historically stored carbon. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric5
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	3	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	2	2			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				1.00	Where groundwater is anaerobic (as it often is) it can stimulate methane emissions, as can its usually circumneutral acidity (Updegraff et al. 1995). As a result less carbon may be sequestered in some groundwater-fed wetlands (Smemo &Yavitt 2006). However, in many wetlands groundwater also increases the levels of iron, calcium, and sulfate in surface water (Heagle et al. 2007) which can result in less methane emission. Lakes and wetlands with large groundwater inputs may have less organic matter in their sediments (Squires et al. 2006), thus generating less methane.	GroundW5
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	0	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	2	2			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of organic matter that is associated with it. However, a Pennsylvania study found that slope wetlands tended to have moderate to high rates of organic matter accretion compared with other wetland geomorphic types (Wardrop & Brooks 1998). Also, methane emissions may be less from sloping wetlands, due to greater aeration of their soils (Tauchnitz et al. 2008).	Gradient5
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Standardise	Rationales	Cell Name
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					The initial sparseness of vegetation in new wetlands suggests that overall carbon stores are less than in some of the more mature wetlands with greater plant cover, diversity, and structural complexity. Aboveground production and soil organic matter have been shown to be less in lands newly restored to wetland conditions than in long-established wetlands (Fennessy et al. 2008). However, many pioneering plants in new wetlands (especially on fertile soils) grow rapidly and thus are fixing large amounts of carbon per plant per unit time. In recovering windfall areas mosses established a dense carpet on windthrow mounds within the first few decades after the disturbance and quickly sequestered carbon. They were found to comprise as much as 25% of understory plant biomass and as much as 50% of understory productivity (den Ouden & Alaback 1996).	NewWet5
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.67	Although burning potentially releases (rather than sequesters) large amounts of carbon from wetland soils, in the longer term, mosses recover within a few decades of surface burns (Kuhry 1994), and occasional surface burning can concentrate soil inorganic material in surface peat, thereby decreasing fuel quality and the likelihood of supporting severe fires in the future. Loss of soil organic matter from burning can also result in a drop in wetland surface elevation, thus promoting wetter conditions and increasing fire resistance for years post-burn (Watts et al. 2015). Although burning produces a period of minimal carbon storage immediately post-fire, vegetation recovery through succession within a few decades promotes long-term persistence of vegetation communities with greater rates of carbon sequestration than those of unburned (late successional) communities (Benscoter et al. 2012).	Burn5
		Burned within past 5 years.	0	0	0			
		Burned 6-10 years ago.	0	1	0			
		Burned 11-30 years ago.	0	3	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	2	2			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	1			0.50	Tillage, regrading, or other soil disturbances can accelerate the decay of soil organic matter rather than supporting sequestration (Waddington & Turetsky 2008). Farming of drained hydric soils is a particular concern, because such soils typically have substantial organic matter that converts to greenhouse gases when tilled and planted annually. However, tillage of compacted soils can reduce methane emissions (Willey & Chameides 2007). Despite associated soil disturbance, selective logging in forested wetlands in some cases may increase carbon sequestration, at least temporarily, if the tree stands and other components of the forest ecosystem become more productive after thinning (Li et al. 2004, D' Amore et al. 2015).	SoilDisturb5

Historical Accumulation	0.41	AVERAGE(SoilDisturb, MossCov, Wettype, Burn, SoilTex, AVERAGE(Warmth, DecidPct, DecidTree, Width, NewWetland))	HistAccum5
Slowed Decomposition	0.58	AVERAGE(Depth, AVERAGE(Freeze, Warmth, MossCov, WetType)	Productiv
Physical Accumulation	0.45	AVERAGE (OutDura, Constric,AqPlantCov, Gradient, IsoWet)	PhysAccum5
Methane Limit	0.65	AVERAGE(MossCov, Sedge, SeasPct, Fluctu, Groundw, TreeForm, PermWpct)	MethLimit5

Function Score for Carbon Sequestration	F	5.71	(2*MAX(HistAccum, PhysAccum) + Productiv +3*MethLimit) /6
Benefits Score for Carbon Sequestration	B		NOTE: No indicators addressing VALUES of this function are currently proposed because its value is diffused throughout the entire planet.

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Organic Nutrient Export	The effectiveness for producing and subsequently exporting organic nutrients, either particulate or dissolved, along with associated compounds and elements such as iron.	OE

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	Longer flow paths allow for more interaction between runoff and wetland vegetation, which potentially leads to removal and export of more decomposed organic matter.	FloDist6
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are most productive at warmer soil or sediment temperatures, and their foliage that contributes organic matter to downslope food chains decomposes most rapidly under warmer conditions (Fissore et al. 2009). Those conditions are described by increasing mean annual temperature. As soil temperatures increase, so does the concentration of DOC in forested wetland soils and streams, and in that form carbon is readily exported (D'Amore et al. 2010). The production of Sphagnum moss in particular is greater in warmer areas (Gunnarsson 2005). However, ice that is more prevalent in cooler regions can erode organic matter and aid its transport out of a wetland during ice-melt periods.	Warmth6
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Carbon from marshes and fens is often more biodegradable (and thus more exportable and valuable to food chains over a wider area) than bog and forested wetland carbon (D'Amore et al. 2010). The same may be true of riparian shrub/forest wetlands, and their connectivity to other water bodies is usually greater, potentially leading to greater export (Dalva & Moore 1991). Bogs usually have the largest amounts of carbon in storage (as peat), and some bogs fix carbon more readily than more fertile wetlands (fens) (Moore 1989, Glenn et al. 2006), but connectivity to other water bodies is generally less than other wetland types, with carbon being exported mainly in dissolved form via groundwater.	Wettype6
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 μS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 μS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	4	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Nitrogen added to a wetland by N-fixing plants can increase the wetland's overall plant productivity, potentially making more organic matter available for export. Presence of alder in conifer woodlands also can speed the decomposition of organic material from the conifers (Fyles & Fyles 1993) perhaps making it more useful for supporting aquatic life.	Nfixer6
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	More extensive ground cover may imply more organic matter is available for export. However, excessive litter buildup implies a lack of significant exporting forces, e.g., currents.	Gcover6
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.25	Soils with a thick organic layer have the most carbon available for export. However, moderately coarse soils (silts, loams) are better-aerated, less acidic, and thus can have greater plant productivity. Very coarse soils, unless flooded regularly by rivers, tend to be nutrient-poor thus limiting plant productivity. However, their presence may indicate periodic exposure to water currents capable of exporting carbon, and coarse soils sometimes support greater plant productivity because greater infiltration can reduce the frequency of anoxic conditions that stifle productivity of some rooted plants.	SoilTex6
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	Prolonged inundation can stifle plant productivity, whereas seasonal inundation encourages it, and is often associated with conditions that contribute to the export of organic matter, e.g., river floods. Seasonally high water levels promote decomposition (Bayley & Mewhort, 2004) and thus facilitate the export of carbon. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct6
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.25	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc6
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	1	1			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	3	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.80	Annual productivity is generally greater in shallower areas where light is more available and sediments are subject to aeration from wind mixing. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth6
		<10 cm deep (but >0).	0	5	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Flowing rather than ponded waters provide the most opportunity for organic matter to be exported from wetlands (Urban et al. 1989, Dalva & Moore 1991). In some regions, flowing waters also tend to be more productive because nutrients from further upstream are continually introduced into the wetland and replenished. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondedPct6
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The probability that organic matter from wetland plants will be exported increases in relation to the percent of the inundated area containing such plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov6
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	6	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.60	The plant material from narrower (fringe) wetlands is often more vulnerable to transport into adjoining waters. However, wider wetlands represent larger total stores of organic matter available for waterborne export downstream or offsite (Pacific et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs6
		<1 m.	0	4	0			
		1 - 9 m.	0	5	0			
		10 - 29 m.	0	4	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	2	0			
		> 100 m, or open water is absent at that time.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of open water with vegetation promotes greater export of organic matter from the vegetation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers6
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Boreal streams are an important transporter of protein-rich, labile DOM (Urban et al. 1989, Gergel et al. 1999, Xenopoulos et al.2003, Fellman et al. 2009). Thus, annual export of accumulated organic matter to downstream water can be greater in wetlands with outlets, especially those with persistent outflow. Nonetheless, even wetlands that lack outlets may export variable amounts of dissolved carbon via subsurface infiltration and "pipes" created by decayed subsurface peat and tree roots which cannot be evaluated in a rapid assessment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura6
		Persistent (surface water flows out for >9 months/year).	1	5	5			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	4	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus limiting export of organic matter. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric6
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	0	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Increased channel complexity implies greater interspersion of open water and vegetation, which provides more opportunity for organic matter to be in contact with moving water and thus be exported. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo6
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	1	1			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater-fed wetlands remain ice-free for longer, thus lengthening the growing season and plant production, and increasing the potential for organic matter to be exported if the wetland is connected to other water bodies. However, groundwater generally contains less dissolved organic carbon than does surface runoff (Emi-Fergus et al. 2011). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw6
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Steeper gradients imply a greater likelihood that whatever organic matter is produced will be transported offsite.	Gradient6
		<2% or the AA has no surface water outlet (not even seasonally).	0	0	0			
		2-5%.	1	2	2			
		6-10%.	0	3	0			
		>10%.	0	4	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Soil organic matter is slow to accumulate in constructed wetlands (Alsfeld et al. 2009), so less is likely to be available for export.	NewWet6
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Historical Accumulation	0.25	AVERAGE(SoilTex, NewWet)	HistAccum6
Current Productivity:	0.47	AVERAGE(Frozen Duration, Plant Cover, Nutrient Availability) WHERE:	Productiv6
Frozen Duration	0.13	AVERAGE(Warmth, Groundw)	FrozDura6
Plant Cover & Type	0.90	AVERAGE (AqPlantCov, Decid, DecidTree, Gcover, Depth)	PlantCov6
Nutrient Availability	0.38	AVERAGE(Wettype, SeasWpct, Fluctu, Nfix)]	NutrAvail6
Export Potential	0.68	AVERAGE [OutDura, Gradient, FloDist, AVERAGE(Constric, ThruFlo, Interspers, Width, PondedPct)]	ExportPot6

Function Score for Organic Nutrient Export	F	5.38	IF((NoOutlet6=1),0, ELSE: (3*ExportPotential+ 2*CurrentProductivity + HistoricalAccumulation) /6

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Anadromous Fish Habitat	The capacity to support rearing or spawning habitat of fish species that migrate from marine waters into freshwater streams to spawn. Catadromous species (e.g., eels that spawn in marine waters but spend most of their life in fresh) are also included.	FR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	If accessible and otherwise suitable for fish, wetlands closer to the coast are more likely to support anadromous species due partly to reduced duration of ice cover, shorter instream migration routes, and potentially elevated aquatic productivity.	TidalProx9
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.15	Wetlands located lower in a watershed are generally more accessible to anadromous fish.	Elev9
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					A wetland exposed to toxic substances has less or no capacity to sustain anadromous fish. Fish are especially sensitive to heavy metals such as copper (Scannell 2009).	ToxData9
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				1.00	Impervious areas do not contribute many terrestrial insects to aquatic food chains, may reduce aquatic productivity due to high turbidity and sedimentation of spawning areas, and can raise stream temperatures to levels harmful to anadromous fish.	ImpervCA9
		<10%.	1	2	2			
		10 to 25%.	0	1	0			
		>25%.	0	0	0			
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				0.50	Regardless of the accessibility and quality of a wetland, if anadromous fish cannot access the larger watershed of which it is a part, the wetland will be unable to currently support anadromous fish.	Access9
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	2	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1	1	1			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Salmon are highly sensitive to water acidity and the effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	Karst9
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Of the wetland types listed, riparian and marsh wetlands are typically most important to anadromous fish because they have the most water and are the most accessible. When accessible, other wetland types are used but invertebrate foods may be less abundant due to acidic conditions.	Wettype9
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, LeSage et al. 2005). From that, it can be inferred that fish production should be higher as well, where food is limiting fish survival.	Nfix9
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Wetlands that are never inundated cannot support anadromous fish directly.	SatPct9
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Areas of persistent water within or adjoining a wetland are necessary to provide refuge, spawning habitat, and travel corridors for all anadromous fish. However, areas of a wetland that dry out seasonally are also important so wetlands that are entirely comprised of persistent water may be no more important than those that have a mix of persistent water areas and seasonally-inundated-only areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct9
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				0.80	Most anadromous fish require relatively cool waters, and shade helps maintain cool water temperatures, especially in lowland streams during low flow conditions. Cool waters (less than 68 degrees F, ideally less than 60F) are particularly important to salmonid fish because at higher temperatures less of the dissolved oxygen necessary for their survival (a minimum of 5 ppm is needed by most local fish) is able to remain in the water. However, shade also can reduce algal productivity and thus the abundance of aquatic insects, although this may be compensated somewhat by increased availability of terrestrial insects that fall off the shading vegetation and into waters where they are fed upon by fish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if water is present only seasonally, or if wetland is in the lower third of a watershed (because shade has less effect on water temperature in the wider channels there).*	Shade9
		<5% of the water is shaded, or no surface water is present then.	0	1	0			
		5-25% of the water is shaded.	0	2	0			
		25-50% of the water is shaded.	0	3	0			
		50-75% of the water is shaded.	0	5	0			
		>75% of the water is shaded.	1	4	4			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	Many studies have demonstrated the importance to anadromous fish of streams and wetlands that are inundated only seasonally, provided fish can enter and exit them then (e.g., Brown & Hartman 1988, Nickelson et al. 1992, Freeman et al. 2007, Meyer et al. 2007, Welsch & Hodgson 2008). Even during brief periods of high water, fish enter those areas and gorge themselves on invertebrates made more available by the flooding. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct9
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	1	3	3			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Except when spawning, most anadromous fish spend much of their time in deep water because of the typically cooler temperatures and cover it provides. Preferred depths vary by species, season, and channel type. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth9
		<10 cm deep (but >0).	0	2	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish, and support higher productivity of invertebrates fed upon by fish. However, as aquatic plants decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov9
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers9
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Many studies have demonstrated that large woody debris is critically important to coho and steelhead. It provides cover and creates instream pools that help protect young fish from aerial predators. Shade from pools also provides cooler water preferred by salmonids. Removal of woody debris from one stream reduced salmonid use to one-fifth the levels with woody debris (Fausch & Northcote 1992). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove9
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Fish access to wetlands is better, and oxygen deficits harmful to fish are less frequent, if outflows from the wetland are persistent (Henning et al. 2006, 2007). Connectivity between tributaries and more permanent mainstem streams is essential to anadromous fish which use many off-channel habitats. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura9
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.67	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo9
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	2	2			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Atlantic salmon eggs and smolts are particularly sensitive to low pH (Rosseland et al. 2001, McCormick et al. 2012). *If pH is between 5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	Acid9
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver9
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Especially in riverine wetlands, groundwater (hyporheic flow) that discharges into wetlands is extremely important to salmonids because of its cooler temperature. However, in some instances this "iron floc" decreases the oxygen required by fish and smothers fish spawning gravels. Groundwater influx is sometimes indicated by an orange precipitate, indicating the presence of iron oxidizing bacteria (Dickman & Rygiel 1998).	GroundW9
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as contributing terrestrial insects (Wipfli 1997) and supporting richer and healthier aquatic invertebrate communities. All of these factors help support anadromous fish. Within 90 years after clear-cut logging without a 100-ft wide stream-side buffer, LWD could be reduced by 70% and recovery to prelogging levels would take more than 250 years. Also, establishment of conifer plantations can acidify receiving waters and potentially harm Atlantic salmon eggs (Kreutzweiser et al. 2008, Drinan et al. 2013, Malcolm et al. 2014). However, overall intensity of land use and forest fragmentation in a stream's watershed sometimes has a greater influence on stream fish abundance than does buffer width (e.g., Shandas & Alberti 2009, Stephenson & Morin 2009). The effects of buffer width or proportion of forest in the watershed can also be overshadowed by differences in stream substrate type and flow duration (Roy et al. 2005).	BuffPctNat9
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	In the Seattle area, salmon were dominant only in streams whose contributing areas contained less than 5% impervious surface. Salmon were essentially absent from streams draining areas with more than 35% impervious surfaces (May et al. 1997). Some types of watershed disturbances are probably more harmful to anadromous fish habitat than others. Impervious surfaces and storm drains, even when occurring at low densities but near drainageways that lead to the same stream or wetland, can dramatically alter the amount, timing, frequency, and duration of flow in streams and water level in lakes and wetlands (Booth et al. 2002, Konrad et al. 2005, Poff et al. 2006, Shields et al. 2008); increase pollutant loads and concentrations (Chadwick et al. 2006, Morgan et al. 2007); disrupt channel configurations (McBride & Booth 2005, Colosimo & Wilcock 2007); shift local air and water temperature regimes (Delgado et al. 2007); introduce chronic noise, predators, and other disturbances (Hepinstall et al. 2008); and as a consequence of these and related factors, alter the abundance, diversity, and species composition of fish and wildlife communities (Miltner et al. 2004, Hansen et al. 2005, Alberti et al. 2007, Walsh & Kunapo 2009, Cookson & Schorr 2009). *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	BuffLU9
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of fish are closely linked to specific thermal, olfactory, and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation timing (to which fish are not adapted) can reduce survival and ultimately populations. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime9
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	1			0.44	High levels of contaminants (especially heavy metals such as copper) can be detrimental to anadromous fish.	ToxinIn9
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0			0.92	Excessive sediment in spawning areas smothers fish eggs, limits aquatic productivity, contributes to surface water warming, and thus potentially adversely affects anadromous fish habitat (Kemp et al. 2011, Sear et al. 2008). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedIn9
#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.50	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopCtr9
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	1	2	2			
		1 - 5 km.	0	1	0			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd9
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core9
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0				A direct indicator of value, at least for some species.	Fishing9
	Function Score for Feeding Waterbird Habitat					0.44	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., loons, grebes, cormorants, kingfisher) and mammals.	WbirdFeed

Hydro Regime	0.69	AVERAGE(Depth, SatPct, MAX(SeasWPct, PermWPct), Lake, Interspers, ThruFlo)	Hydropd9
Structure	0.83	AVERAGE[Beaver, AVERAGE(Wettype, WoodAbove, AqPlantCov, Shade, IsoWet)]	Struc9
Productivity	0.25	AVERAGE(GroundW, TidalProx, Elev, Wettype, Karst, Nfix)	Produc9
Landscape	0.83	AVERAGE(NatVegPctCU, BuffLU, ImpervCA)	Lscape9
Stressors	0.44	MIN(Acid, ToxicIn, SedIn, AltTime, ToxData)	Stress9

Function Score for Anadromous Fish Habitat	F	4.56	IF((Access=0),0,
			IF((AllSat1=0),0, ELSE:
			(AVERAGE(Access, OutDura)) X (AVERAGE(HydroRegime, Structure, Productivity, LScape, Stress))

Benefits Score for Anadromous Fish Habitat	V	1.87	AVERAGE(WbirdFeed, Fishing, Core, PopCtr, DistRd)

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Resident Fish Habitat		The capacity to support an abundance and diversity of native fish (both resident and visiting species) that are not anadromous or catadromous, e.g., Dolly Varden, cutthroat trout.	FR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Obviously, a wetland containing toxic substances has much less capacity to support anadromous fish. Resident fish are especially prone to bioaccumulation of locally-sourced metals (e.g., Deniseger et al. 1990).	ToxData10
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects and ultimately resident fish. Risk of winterkill by long-duration ice cover also may be less in warmer parts of the region.	Warmth10
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				1.00	Increased access to wetlands by anadromous fish can make other fish more vulnerable to competition or predation by anadromous fish. For non-anadromous fish, access to other water bodies is helpful to escape temporary oxygen deficits (particularly under ice in winter) and to access additional food and spawning areas, but is not always essential.	Access10
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1	1	1			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Many fish and their supporting aquatic food webs are sensitive to water acidity. The effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Of the wetland types listed, riparian and marsh wetlands are typically most important because they have the most water and are the most accessible to resident fish. When accessible, other wetland types are used but invertebrate foods may be less abundant in those due to acidic conditions.	Wettype10
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005). From that, it can be inferred that fish production should be higher in alder wetlands as well, where food is limiting fish survival.	Nfix10
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Even if not connected to other water bodies, lakes are used extensively by resident fish, and lakeside wetlands provide shelter, rich feeding areas, and substrate for spawning by some species. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Lake10
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Used as a classifier. Wetlands that are never inundated cannot support resident fish.	SatPct10
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Persistent surface water is essential to resident fish in isolated wetlands, and is important to resident fish even in wetlands that connect seasonally to other water bodies. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct10
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Most resident fish spend much of their time in deeper water because of the cover it provides. Wetlands with deeper water provide more habitat space. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth10
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different resident fish species have different habitat needs, and a variety of depths within a wetland implies greater capacity of the wetland to meet the needs of multiple species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 10
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish and in some cases the associated shading helps maintain cool water temperature. However, as they decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct10
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides resident fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers10
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect young fish from aerial predators and provides cooler water preferred by salmonids. *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	WoodAbove 10
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Fish access to wetlands is better if an outlet is present and outflows from the wetland are persistent. Although isolated wetlands with persistent surface water can support some resident fish, a permanent connection to other surface waters increases the ability of fish to move among wetlands and other surface waters in search of food and other needs. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura10
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.67	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo10
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	2	2			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Fewer resident fish thrive in acidic (low pH) wetlands and ponds. However, as pond size increases and they begin to resemble lakes, pH often increases and consequently the ability to support a wider array of fish (Rempel & Colby 1991, Kimmel & Argent 2010, Sutela et al. 2010). *If pH is between 7.5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	AcidicPool10
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce more fish (Rempel & Colby 1991, Kimmel & Argent 2010) but levels greater than about 2000 mg/L TDS are usually harmful (Weber-Scannell & Duffy 2007). *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm or if plants indicate highly saline conditions. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other measurements are assigned a score of 0.5.*	Conduc10
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver10
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater provides relatively warm temperatures that can maintain ice-free conditions for longer, and helps sustain water levels and low flows, thus increasing annual production. However, the "flocs" created by the presence of iron oxidizing bacteria in some instances causes groundwater to be deficient in oxygen that is critical to resident fish, especially when this occurs under winter ice cover.	Groundw10
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as supporting richer and healthier communities of fish as well as invertebrates. Often, only very tolerant fish species are present in streams in heavily urbanized areas (Yoder et al. 1999) and invasive species may enjoy a competitive advantage over native species under urban conditions.	NatVegCU pct10
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of resident fish are closely synchronized to natural hydrologic patterns. Wetlands where that has been disrupted will have lower capacity to support resident fish. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime10
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0			0.92	Excessive sediment limits aquatic productivity, contributes to surface water warming, and thus adversely affects resident fish habitat (e.g., Gray et al. 2005). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedExcess 10

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.40	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopDist10
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	1	2	2			
		1 - 5 km.	0	1	0			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd10
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core10
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0			0.00	A direct indicator of value, at least for some species.	Fishing10
	Function Score for Feeding Waterbird Habitat		4.37			0.44	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as birds (e.g., loons, grebes, cormorants, kingfisher).	WbirdFeed 10

Hydro Regime	0.45	AVERAGE(SatPct, Depth, DepthEven, PermWPct, Interspers, ThruFlo)	Hydro10
Structure	0.50	AVERAGE[Beaver, AVERAGE(Wettype, Shade, WoodAbove, ABpct, AqCov)]	Struc10
Productivity	0.08	AVERAGE(InletOutlet, GroundW, NewWetland, Wettype, Conduc, Karst, Nfix, Lake)	Produc10
Anoxia Risk	0.46	AVERAGE (OutDura, Depth, Warmth)	AnoxRisk10
Stressors	0.50	MIN(SedExcess, Acid, AltTime, ToxData, 1-NatVegCUpct)	Stress10

Function Score for Resident Fish Habitat	F	3.99	IF((Fish Access=0),0,
			IF((Water=0),0, ELSE:
			AVERAGE(HydroRegime, Structure, Productivity, AnoxiaRisk, Stress))

Benefits Score for Resident Fish Habitat	B	1.67	AVERAGE(Feeding Waterbird Habitat score, Fishing, PopDist, DistRd, Core)))

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Invertebrate Habitat		The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	INV					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.40	Other factors being equal, wetlands closer to the coast tend to be more fertile due to deposition of airborne nutrients from marine waters. This potentially supports higher invertebrate numbers and perhaps diversity.	TidalProx8
		<100 m.	0	5	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				1.00	Macroinvertebrate and fish community composition is impacted beginning at about 5% impervious surface, a number that varies depending on the proportion of agricultural land as well (Waite et al. 2008). Comparing data from multiple regions, Utz et al. (2009) reported that aquatic invertebrates sensitive to impervious cover were generally lost when impervious cover was in the range of 3% (most sensitive taxa) to 23%.	ImpervCA
		<10%.	1	3	3			
		10 to 25%.	0	2	0			
		>25%.	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	warmth8
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to	0			0.00	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	karst8
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Many invertebrate groups (e.g., snails, isopods, lumbricid worms) cannot tolerate acidic conditions of bogs, and invertebrate richness generally tends to be greater in persistently inundated fens than in less persistently inundated marshes with more mineral soils (Holmquist et al. 2011). Marshes along lakes and rivers tend to have water longer into the growing season than other marshes and can support high abundance and diversity of invertebrates. One study reported that bogs and fens did not differ significantly with regard to invertebrate faunas. Dragonflies seemed to respond to the habitat's form and structure more than to its acidity or nutrient levels (Cannings & Cannings 1994)	Wettype8
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type				0.00	Because different wetland types are likely to support different species assemblages and many of those species may require complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	Subtypes8
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.33			0.33	On a per-surface-area basis, deciduous trees and shrubs often support higher levels of insect biomass than conifers, at least among nocturnal flying insects (Ober and Hayes 2008). *In calculations, is excluded automatically (cell goes blank) if few or no trees in the wetland. Score is based on the maximum cover of any of the 3 woody deciduous height classes, adjusted to the 0-1 scale.*	DecidTree8
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				1.00	Woody vegetation adds vertical habitat space, bark, and dead wood used by many invertebrates, whereas herbaceous vegetation has generally greater annual productivity. A well-interspersed even mix of both is hypothesized to maximize invertebrate diversity and productivity. In calculations, is excluded automatically (cell goes blank) if few or no trees or shrubs are present.	WoodHerb Mix8
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides food, cover, and a stable microclimate for many invertebrates that live in soil and peat of wetlands that seldom flood. In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation in the wetland. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown8
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1	1	1			
F9	N Fixers	Nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, other legumes) comprise:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005).	Nfixers8
		<1% of the shrub cover and <1% of the ground cover, or trees are the only cover.	0	0	0			
		1-25% of the shrub cover (if shrubs/trees are the dominant cover) or 1-25% of the ground cover (if herbaceous plants are the dominant cover).	1	1	1			
		25-50% of the shrub cover (if shrubs/trees are the dominant cover) or 25-50% of the ground cover (if herbaceous plants are the dominant cover).	0	2	0			
		50-75% of the shrub cover (if shrubs/trees are the dominant cover) or 50-75% of the ground cover (if herbaceous plants are the dominant cover).	0	3	0			
		>75% of the shrub cover (if shrubs/trees are the dominant cover) or >75% % of the ground cover (if herbaceous plants are the dominant cover).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Vegetation provides more food and cover to invertebrates than do bare areas, so invertebrate density and diversity is typically greater.	Gcover8
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Greater microtopography implies greater heterogeneity of water, vegetation, and disturbance regimes, which together should indicate higher capacity to support a wide variety of invertebrates.	Girreg8
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	The second condition implies greater diversity of plants, which sometimes is associated with greater diversity of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous vegetation in the wetland.*	HerbDiv8
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.67	The larvae of many wetland invertebrates require surface water, so the absence or scarcity of that limits aquatic invertebrate richness.	SatPct8
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	1	4	4			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Wetlands in which surface water persists longer are capable of supporting a wider variety of invertebrates, e.g., those that require many months or years to complete their life cycle, as well as those that mature more rapidly. Thus, wetlands with a proportionately large extent of persistent water may benefit a wide range of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct8
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	The parts of a wetland that are inundated only seasonally may contain water long enough for many invertebrates to complete their life cycle, while providing fresh food resources (e.g., plant litter). They also tend to be shallower and less deficient in dissolved oxygen, making them suitable for a wider range of species. Seasonal fluctuations release nutrients bound up in wetland sediments, and stimulate the growth of new plants whose seeds have been dormant. However, some invertebrate taxa, such as those without winged adult stages living in isolated wetlands (bog pools), may not survive prolonged desiccation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct8
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	1	3	3			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. Also, more stable water levels may benefit aquatic invertebrates in regions where many streams and wetlands are prone to sudden fluctuations from melting snow and storms. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc8
		<10 cm change (stable or nearly so).	0	3	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				1.00	Provided that they hold surface water for several weeks, shallow areas support greater primary production, support higher vascular plant densities, and consequently greater invertebrate production. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth8
		<10 cm deep (but >0).	0	3	0			
		10 - 50 cm deep.	1	5	5			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different invertebrate groups thrive at different water depths in boreal wetlands (Corcoran et al. 2009). Thus, a variety of depths may promote greater invertebrate richness for the wetland as a whole. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthDiv8
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.25	Many wetland invertebrates reach their greatest density in ponded areas. That is partly because the isolation protects them from predation by fish that normally inhabit the channels (Hornung & Foote 2006). Flowing water in channels favours different invertebrate assemblages, which when combined with the contribution of pools, adds to the overall diversity of the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet8
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	2	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Emergent and submerged vegetation typically hosts extensive growths of epiphytic algae, which along with the supporting herbaceous plants, provide food and cover for a wide variety of invertebrates. Intermediate cover conditions allow more light penetration of the water column, higher algal productivity, greater oxygenation, and thus tend to support a wide variety of invertebrate groups. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct8
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater invertebrate diversity overall may be supported by wetlands with a relatively even mix of open water and vegetation, interspersed throughout. Such conditions reflect a variety of light, temperature, and oxygen regimes as well as edge habitats (ecotones) that together provide more niches for invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers8
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					The importance of large wood to aquatic life has been widely documented in perennial streams (literature reviewed by Murphy 1995, May 2003, Wenger 2000, Knutson and Naef 1997) and in lakes (Roth et al. 2007). Many aquatic invertebrates attach to submerged wood and feed on algae and leaves associated with it. Constructed wetlands to which woody debris is added may support greater biomass or richness of several aquatic invertebrate groups (e.g., Alsfeld et al. 2009). Most instream wood originates in the parts of the riparian areas that are within 100 ft of a stream (McDade et al. 1990, Van Sickle & Gregory 1990, Robison & Beschta 1990, Meleason et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	AqCov8
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for invertebrates, so should result in greater species richness. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo8
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	0	1	0			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	1	1	1			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce greater biomass of aquatic invertebrates. *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other conditions are assigned a score of 0.5.*	Conduc8
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater provides a relatively steady input of nutrients (e.g., Morley et al. 2011). That can support greater algal production and consequently greater invertebrate production and perhaps diversity. It also provides relatively warm temperatures and helps sustain low flows, thus increasing annual production of invertebrates (Brown et al. 2007). However, where underlying geologic strata are iron-rich, groundwater discharge is often accompanied by precipitation of iron "floc" in wetland sediment, smothering aquatic invertebrates and reducing their diversity. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw8
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Comparing data from multiple regions, Utz et al. (2009) reported that once urbanization in a watershed reached 60%, all taxa remaining responded either neutrally or positively with respect to continued urbanization. Most were harmed at much lower levels. The importance of streamside vegetation, especially trees, for sustaining the health of aquatic systems has been documented in the Pacific Northwest (e.g., Gregory et al. 1991, Naiman et al. 2000, Richardson et al. 2005, Wipfli et al. 2007). The positive effect is partly because wood falling into streams increases channel complexity which benefits aquatic invertebrates and fish; that may not apply to wood falling into wetlands. Trees also help maintain stream temperature and streams adjoined by natural vegetation support richer and healthier aquatic invertebrate communities (Richards et al. 1996). However, the effects of buffers and/or tree canopy closure on aquatic life in perennial streams vary, with some studies showing little effect on native fish (Roy et al. 2005, Fischer et al. 2010) and others a positive effect especially when buffer width was at least 100 ft (Frimpong et al. 2005, Horwitz et al. 2008). A 30-ft wide buffer along perennial streams in British Columbia was found to be insufficient to protect stream invertebrate communities from adverse effects of clear-cut logging, although the terrestrial insects the buffer provided were noted as a potentially important food source for fish using the streams (Hoover et al. 2007). Another study of BC perennial streams found uncut riparian buffers of at least 30 ft were needed to limit changes from clear-cut logging to aquatic life in headwater forested watersheds; those changes included increase abundance of aquatic invertebrates and algae (Kiffney et al. 2003). Increased sunlight from vegetation removal can increase stream and wetland productivity and thus the density of some invertebrate groups, where nutrients and elevation (stream temperature) are not severely limiting (Moldenke & Linden 2007).	NatVegPctC8
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Unvegetated uplands provide the least refuge for emerging aquatic insects, and also are most likely to contribute contaminants and disturb runoff patterns. Agricultural land cover seemed less impacting than impervious cover. Most organisms were capable of tolerating high levels of agricultural land cover, but a few disappeared when agricultural land cover exceeded 21% of the watershed area. *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	CUbuffLUtyp8
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	Life histories of most invertebrates are closely linked to specific thermal and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation to which invertebrate communities are not adapted may reduce populations of many intolerant invertebrate species and in some cases diminish local biodiversity (Bunn & Arthington 2002).	AltTime8a
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.08			0.92	Aquatic invertebrate communities (both benthic and planktonic) are harmed by excessive sedimentation and turbidity from sediment runoff. Sediment from timber-harvest activity (clearings and roads) can intensify the turbidity effects of spawning-salmon disturbance on macroinvertebrates. The deposition of fine sediment can limit populations of grazing invertebrates even when algal foods become more available following timber harvest (Kiffney & Bull 2000).	SedCA8a
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.50			0.50	Many wetland invertebrates inhabit the soil, and potentially are harmed by soil disturbance such as from tillage or compaction.	SoilDisturb8a
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
	Function Score for Anadromous Fish Habitat					0.46	Aquatic invertebrates are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as fish, bats, and birds (Baxter et al. 2005, Gende & Wilson 2001, Christie & Reimchen 2008).	
	Function Score for Resident Fish Habitat					0.40		
	Function Score for Amphibian Habitat					0.58		
	Function Score for Feeding Waterbird Habitat					0.44		
	Function Score for Nesting Waterbird Habitat					0.30		
	Function Score for Songbird, Raptor, & Mammal Habitat					0.82		

Structure	0.90	AVERAGE [ABpct, AVERAGE(AqCov, WoodHerbMix, HerbDiv, Gcover, WoodDown, Girreg)]	Structure8
Hydroperiod	0.67	AVERAGE [PermWpct, SatPct, SeasPct, Fluctu,GroundW)]	Hydropd8
Connectivity		AVERAGE(Interspers, ThruFlo, IsoWet)	Connec8
Productivity	0.52	AVERAGE [WetType, AVERAGE(Depth, Warmth, DecidTree, Hardwood, WoodDown, Nfixers, Conduc, TidalProx, Karst)]	Food8
Landscape	0.63	AVERAGE(Imperv, NatVegPctCU, CUbuffLUtype, Subtypes)	Lscape8
Stressors	0.72	AVERAGE(AltTime, SedCA, SoilDisturb)	Stressors8

Function Score for Aquatic Invertebrate Habitat	F	6.97	AVERAGE [Struc, Productivity, AVERAGE(Hydropd, Connec, Stressors, LScape]
Benefits Score for Aquatic Invertebrate Habitat	B	4.99	AVERAGE(AnadFish, ResFish, Amphib, WbirdF, WbirdNest, SongbMam)

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Amphibian & Turtle Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	AM						
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.63	Larger contiguous tracts of nearby natural land, especially natural forest land, are more likely than small or fragmented patches to meet the habitat needs of dispersing and summering amphibians (Cushman 2006). Some New Brunswick data indicate tree plantations may be less suitable than natural forest for amphibians (Waldick et al. 1999), and clearcuts in Maine were found to be unsuitable even when logs and other coarse material was retained (Popescu et al. 2012).	NatVegSize11
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	1	5	5			
		100 to 1000 hectares.	0	6	0			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.57	Amphibians require upland habitat as well as aquatic habitat (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially natural forest within 1 km, usually provide the most suitable microclimates and habitat structure (Mazerolle et al. 2005, Baldwin et al. 2006a). Unvegetated or artificially vegetated areas, such as clearcuts and tree plantations (Waldick et al. 1999, Patrick et al. 2006), can inhibit movements of some species within upland habitats and reduce population viability. When radiotracked frogs on Vancouver Island were released inside clusters of trees amidst otherwise unsuitable habitat (clearcuts), the proportion of frogs abandoning the tree cluster was greater the smaller the cluster. Frogs were less likely to leave tree patches intersected by a running stream or where neighborhood stream density was high. Scattered tree patches of at least 1 ha, preferably in stream locations, were the minimum needed to allow normal overland passage of one frog species (Chan-McLeod & Moy 2007). The amount of forest surrounding a wetland is a strong positive predictor of amphibian richness and/or abundance (Findlay & Houlahan 1997), even more so than the amount of other surrounding wetlands (Quesnelle et al. 2015). However, on Prince Edward Island, no evidence was found to suggest that patch area or perimeter affects amphibian species richness (Silva et al. 2003).	NatVegProx11
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	7	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.60	See above.	NatCov2mi11
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	2	0			
		20 to 60% of the land.	1	3	3			
		60 to 90% of the land.	0	4	0			
		>90% of the land. SKIP to OF10.	0	5	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type of non-natural land cover that surrounds a wetland can influence dispersal success of amphibians. Unvegetated lands are usually the least suitable. Clearcuts may be better but perhaps still not as suitable as natural cover on soils of similar productivity (Waldick et al. 1999).	ScapeLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Roads and/or traffic are a significant barrier to or hazard for dispersing amphibians, as demonstrated both in this region (Mazerolle 2004, Maxerolle & Desrochers 2005, Mazerolle et al. 2005, Jacobs & Houlahan 2011, Gravel et al. 2012) and elsewhere (Mader 1984, Fahrig et al. 1995, and see review by Fahrig & Rytwinski 2009). Roads with as few as 10 vehicles per hour can still have significant amphibian roadkill (Mazerolle 2004). Even some narrow logging roads that had long been abandoned continued to impair movements and densities of salamanders in North Carolina; the road effect appeared to extend about 35 m into the adjoining woods on both sides of the road (Semlitsch et al. 2007).	RdDis11
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	7	7			
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	During certain times of their life cycle, frogs, turtles, and salamanders must move from their breeding wetlands into other wetlands or uplands with natural vegetation (Patrick et al. 2007, 2008). Pavement and other open surfaces act as barriers to these essential movements, and individuals that do attempt to cross roads are often crushed by vehicles (see above). In Ontario (Eigenbrod 2008a) and Virginia (Marsh 2007), “accessible habitat” -- defined as the habitat available to pond-dwelling amphibians without individuals needing to cross a major road -- was a better predictor of amphibian species richness than simply the amount of habitat within some distance of breeding ponds (Eigenbrod 2008b).	RoadCirc11
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.57	In this region, amphibians have been shown to occur more frequently in wetlands located close to other wetlands, or with a large number of other wetlands in close proximity (Stevens et al. 2002, Mazerolle et al. 2005, Jacobs & Houlahan 2011). That is because many species in these groups move regularly among wetlands in order to meet different life history needs (Gibbs 1993).	PondProx11
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					High levels of these substances, such as from livestock use or wastewater effluent, can harm amphibian populations and reduce amphibian diversity, e.g., Schmutzer et al. 2008). In calculations, the indicator score is set to 0 if those contaminants are present within the AA, is set to 0.2 if within 1 km and connected, is set to 1 if sampling shows no problems, or is set to blank (indicator is ignored) if data are insufficient.	Toxic11
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.67	Because amphibians and reptiles do not physiologically regulate their body temperatures and some are at the northern limit of their range in this region, it can be assumed that they may favour warmer microhabitats overall. Wetlands fed by water from south-facing slopes would be expected to be warmer, but the possible effect on amphibians has not been widely tested.	Aspect11
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	0	3	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	2	2			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Amphibians do not physiologically regulate their body temperature. Thus their populations are likely to be more productive (and have greater survival) in warmer parts of the region.	_GDD11

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true]:					Populations of some amphibians seem to thrive best in fishless wetlands. In some regions, predatory fish (especially, exotic species) severely reduce populations of native species (Pearl et al. 2005). *In calculations, if wetland is fishless it is scored as a 1 but if fish present this indicator is ignored in model calculations.*	FishAcc11
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	0	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1	0	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	1	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			0.00	Areas of calcareous bedrock (karst landforms) tend to have more naturally-formed crevices and tunnels that could provide cover for amphibians during their terrestrial phases. Karst also tends to support higher aquatic productivity. *In calculations, the 0-3 category is first divided by 3.*	Karst11
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Marshes and fens are most likely to provide favored breeding habitat (e.g., Houlahan & Findlay 2003) andt many swamps contain important vernal breeding pools as well as providing excellent cover for dispersing adults. Some swamps in floodplains, however, have water levels that are too dynamic to support breeding by some amphibian speces.	Wettype11
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of amphibian species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv11
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.44	During certain months of the year many salamanders and some frogs and toads require the moist microclimate and abundant invertebrate foods found in or under large downed wood in the uplands surrounding wetlands. Forests with large-diameter trees are most likely to have such conditions and in this region, American bullfrog and mink frog are more likely to occur in wetlands with nearby mature and overmature forest (Jacobs & Houlahan 2011). The dominant type of vegetation, both near a stream and in a watershed generally, also has the potential to strongly influence aquatic productivity (Ball et al. 2010) and thus tadpole survival, with deciduous vegetation usually indicating greater nutrient and light availability. However, one survey in this region found fewer amphibian species in wetlands surrounded by hardwood (deciduous) forest (Jacobs & Houlahan 2011). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeVar11
		coniferous, 1-9 cm diameter and >1 m tall.	1	1	1			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	1	2	2			
		broad-leaved deciduous 10-19 cm diameter.	0	2	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	3	0			
		coniferous, >40 cm diameter.	0	4	0			
		broad-leaved deciduous >40 cm diameter.	0	4	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				1.00	Interspersion of a balanced mix of concealing woody cover and warmer more food-rich openings of herbaceous vegetation probably provides optimal terrestrial habitat for most amphibians and turtles.	WoodHerbMix11
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides food, cover, and a stable microclimate for many salamanders (Patrick et al. 2006) as well as frogs and toads that move between wetlands (Freedman et al. 1996) but its presence may not be enough to offset broader changes in land cover (Popescu et al. 2012). *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown11
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1	1	1			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.67	Although many amphibians may benefit from warmer temperatures associated with sparser ground cover within a wetland, dense ground cover provides better protection from predators (Mazerolle & Desrochers 2005). Thus, intermediate levels are scored highest.	Gcover11
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	2	2			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	3	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Complex microtopography provides many suitable microclimates important to survival of adult amphibians during the late summer, fall, and winter.	Girreg11
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F13	Upland Inclusions	Within the AA, inclusions of upland are:				0.67	To meet all their life history requirements, most amphibians require uplands in close proximity to, or interspersed within, suitable wetlands.	Inclus11
		Few or none.	0	1	0			
		Intermediate (1 - 10% of vegetated part of the AA).	1	2	2			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	3	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.50	Although shade provided by wider buffers is beneficial to many aquatic species, populations of a few species of native frogs, pond-breeding salamanders, and aquatic invertebrates sometimes increase following partial removal of woody cover. Gaps in woody cover imply less shading and thus warmer water temperatures and algae, increasing aquatic productivity as long as sediment inputs do not increase greatly at the same time (Murphy et al. 1981, Hawkins et al. 1983). *In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation is present.*	ShrubSun11
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	1	0			
		5-25% of the vegetated part of the AA.	1	2	2			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	3	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.67	Wetlands that contain at least a little surface water support breeding amphibians, but even those that lack surface water throughout the year may still provide dispersal sites for adult frogs, toads, and salamanders.	SatPct11
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	1	4	4			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.67	Surface water that persists for all or nearly all of the year provides reproductive as well as feeding and overwintering habitat for most amphibian species (Baldwin et al. 2006a). However, risk of fish predation may be greater in some persistently inundated wetlands if they are fish-accessible. Ideally, a wetland should exist as part of a mosaic of wetlands with different water regimes (Gibbs 1993). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct11
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.80	Egg masses of many frogs and aquatic salamanders are more susceptible to stranding in wetlands with large water level fluctuations. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu11
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Pools that remain isolated from other surface waters even during high water provide amphibians with the most protection from predatory fish. More amphibian species prefer ponded water than water flowing in channels. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet11
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The eggs and larvae of many frogs and aquatic salamanders can easily be harmed by excessive ultraviolet radiation. Aquatic plants may provide some degree of shelter from such radiation, as well as providing attachment surfaces for eggs. However, one survey found that, among wetlands in this region, amphibian richness increased with increasing open water area (Stevens et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct11
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider bands of wetland vegetation help protect a wetland's open waters from contaminants carried in from adjoining uplands. Wider bands of wetland vegetation also provide better cover for young frogs and salamanders as they transition to upland nonbreeding areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth11
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Unshaded open water areas potentially provide warmer conditions favoured by many amphibians, while nearby areas with cover provide protection from predators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers11
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect frogs and aquatic salamanders from aerial predators, and provides important basking sites. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove11
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Under many circumstances, a pH of less than about 4.5 inhibits reproduction and growth of most amphibians (Freda 1986). However, a survey of 159 Nova Scotia wetlands and ponds found green frog tadpoles in a wetland with pH 3.9, and six of 11 amphibian species were found in at least one wetland with a pH of less than 4.5 (Dale et al. 1985). Wood frogs appeared to be the most acid-tolerant, overall. *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acidic11
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands with substantial groundwater inputs tend to have more stable and reliable water levels, thus increasing the likelihood of amphibians breeding successfully. Also, winter water temperatures are warmer than most receiving surface waters. However, the cooler temperatures in summer associated with groundwater input may be less favourable to development of some amphibians. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx. Otherwise is rated based on response in column D.*	GroundW11
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.60	To meet all their life history requirements in this region, most amphibians require other wetlands and uplands in close proximity to, or interspersed within, suitable breeding wetlands (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially forest (Stevens et al. 2002), usually provide the most suitable microclimates and habitat structure. To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts et al 2005). Buffers narrower than 100 m will not protect most amphibian populations (Powell & Babbitt 2015).	NatVegPct11
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	This indicator is similar to the one above but focuses specifically on the type of unsuitable land cover closest to the wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Increased visitation by humans and pets can potentially increase the spread of aquatic fungi that are lethal to many amphibians.	Core1_11
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2_11
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Excessive human traffic and free-roaming pets can harm native amphibians directly (collecting and predation) and indirectly (habitat alteration), so measures to reduce such impacts are given credit.	BMP11
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	1			0.44	Amphibians are highly sensitive to many contaminants. These include road salt (Collins & Russell 2009), which is not necessarily diluted by spring rains to harmless levels (Karraker & Gibbs 2011).	ToxicIn11
#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of amphibians on a wetland (and thus its importance) increases if no other natural vegetation of comparable type and extent is available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1		0	0.33	See above.	WoodyUniq
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of amphibians on a wetland (and thus its importance) increases if no other wetlands or ponds are in the vicinity.	DistPond10
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to amphibian biodiversity at a regional scale.	RareHerp
	Function Score for Feeding Waterbird Habitat					0.44	Amphibians are especially valued when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., herons) and mammals which prey upon them.	WBFscore10
	Function Score for Songbird, Raptor, & Mammal Habitat					0.82		SBMscore10

Hydro Regime	0.53	AVERAGE(Fluctu, SatPct, PermWpct, ISOwet)	Hydro11
Aquatic Structure		AVERAGE(ABpct, WoodAbove, Interspers, Vwidth)	AqStruc11
Terrestrial Structure	0.64	AVERAGE(WoodHerbMix, WoodDown, ShrubSun, Gcover, Girreg, Inclus, WetTypeDiv)	TerrStruc11
Productivity	0.31	AVERAGE(Aspect, GDD,TreeVar, GroundW, Karst)	Produc11
Landscape	0.37	AVERAGE[RoadCirc, AVERAGE(NatVegPct, BuffLU, NatVegProx, NatCov2mi, ScapeLU, NatVegSize)]	Lscape11
Waterscape	0.57	PondProx	Waterscape 11
Stressors (lack of)	0.89	AVERAGE(FishAcc, AVERAGE(RdDis, Toxic, Core1, Core2, BMP)	Stress11

Function Score for Amphibian Habitat	F	5.85	AVERAGE [(Wettype, Hydro, AVERAGE(AqStruc, TerrStruc, Produc, Lscape, Waterscape, Stress)]
Benefits Score for Amphibian Habitat	B	5.29	IF((RareHerp=1),1, ELSE: AVERAGE(WBFscore, MAX(HerbUniq, WoodyUniq, DistPond), SBMscore)

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Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	WBF

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.00	Larger wetlands are used disproportionately by feeding waterbirds. Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex.	AreaTotal12
		<0.01 hectare (about 10 m x 10 m).	1	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	4	0			
		1 to 10 hectares.	0	5	0			
		10 to 100 hectares.	0	6	0			
		>100 hectares.	0	8	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:					Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Although they will fly much farther than 1 km to reach other wetlands and water bodies (Haig et al. 1998), 1 km is used as a practical distance for identifying such features in aerial images.	PondProx12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:					Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is because they provide greater buffer against predators, are more likely to have productive fish populations, and are sufficiently long for waterbird species that cannot take flight by leaping directly upward.	BigPondProx12
		<100 m.	0	5	0			
		100 m - 1 km.	0	4	0			
		1 -2 km.	0	3	0			
		2-5 km.	1	2	2			
		5-10 km.	0	1	0			
		>10 km.	0	0	0			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.22	Wetlands with maritime climate are more likely to have conditions favourable to feeding and wintering waterbirds in this region. Many migratory waterbirds in the Maritimes follow a coastal route. Some non-tidal marshes (such as many dyked fields) that are within a few kilometers of tidal mudflats support large numbers of roosting migratory shorebirds.	TidalProx12
		<100 m.	0	9	0			
		100 m - 1 km.	0	7	0			
		1 - 5 km.	0	6	0			
		5-10 km.	0	4	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term. This indicator denotes potential or actual exposure.	_Tox12
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer mean annual temperature implies higher aquatic productivity and a longer period during which surface waters remain ice-free and thus usable by waterbirds.	Warmth12
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Especially during migration, the diversity of waterbirds may be greater in wetlands with fish because many wetland birds (e.g., loons, herons) feed extensively on fish. *In calculations, receives maximum indicator score if wetland has fish, but if fish absent, this indicator is ignored.*	Fish12a
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1	1	1			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Most feeding waterbirds are naturally drawn to more productive wetlands, which tend to be marshes, especially those along rivers and lakes (Thormann & Bayley 1997, Epners et al. 2010). A lack of surface water in bogs and swamps makes them less suitable for most waterbirds.	Wettype12
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of feeding waterbird species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv12
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]				0.00	Mudflats and seasonally inundated shortgrass flats (including farmed wetlands, Taft & Haig 2005) are important to large numbers of migratory waterbirds.	Mudflat12
		None, or <100 sq. m.	1	0	0			
		100-1000 sq. m.	0	2	0			
		1000 – 10,000 sq. m.	0	3	0			
		>10,000 sq. m.	0	4	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.40	Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008).	EmPct12
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	0	0			
		5-25% of the vegetated part of the AA.	1	2	2			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Fringe wetlands are often used by more wetland birds partly because the adjoining wide expanses of open water can provide refuge from disturbances as well as additional foods. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fringe12
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Larger water bodies such as lakes tend to attract higher densities of waterbirds, other factors being equal (e.g., Savard et al. 1994).	Lake12a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Although wetlands that never contain surface water may still be visited by feeding waterbirds, they are used by fewer species.	SatPct12
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.33	Surface water that persists for all or most of a year provides more feeding opportunities for wetland birds. If no surface water persists throughout a year, waterbird use of the wetland for feeding can still be substantial if the wetland borders a lake, large river, or estuary. Areas that are flooded only seasonally can be very productive when flooded. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct12
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	Wetlands that flood only seasonally tend to be more productive and are immensely important as feeding and resting areas for migratory waterbirds. Occasional severe flood or drought can rejuvenate wetland productivity, and thus waterbird feeding opportunities, by stimulating release of nutrients from sediments or soil. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct12
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	1	3	3			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Shallower water depths support greater aquatic productivity and thus are attractive to many feeding waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth12
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different waterbird species prefer feeding in different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of feeding birds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 12
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds feed more in ponded areas than along channels. Especially at times of high water in channels, off-channel ponded areas provide refuge for many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet12
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					For most waterbirds, intermediate proportions of open ponded water and vegetation appear to provide the best protection from predators and the elements, as well as the richest feeding opportunities (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct12
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	7	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Aquatic plant cover and the abundant invertebrates it supports are favored by many waterbird species. Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods, and waterbird use of such wetlands is usually significantly greater (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers12
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				These plants usually indicate highly enriched conditions, and those tend to be more productive feeding areas for most waterbird species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. In calculations, is counted as a positive if present but does not decrease score if absent.*	Algae12
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Food availability for most waterbird species in this region is greatest in wetlands whose pH is >7.5 (basic pH) and significantly less where pH is less than about 6.5 (Hanson & Calkins 1996). *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 7.5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acid12
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver are a key driver for increasing and maintaining open water area throughout a region (Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver12
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope and riverine wetlands.	Gradient12
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core12a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core12b
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Frequent traffic by people and free-roaming pets can stress some waterbirds, so measures to reduce such impacts are given credit.	BMP12

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq12
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.50	If they attract waterbirds, wetlands closer to settled areas may also attract greater bird-centered use by humans (e.g., birdwatching, hunting) thus increasing their value.	PopCtr12
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	1	2	2			
		1 - 5 km.	0	1	0			
		>5 km.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare12
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Such areas have been chosen through a systematic selection process by biologists and birders in each state.	Ibird12v
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				0.00	Human enjoyment of waterbirds (birding, hunting) is facilitated where wetlands are largely visible from major access points. This increases the value of any level of feeding waterbird function.	Visib12
		<25%.	1	0	0			
		25-50%.	0	1	0			
		>50%.	0	2	0			
F64	Consumptive Uses (Provisioning Services)	Waterfowl hunting.	0			0.00	A direct (but hardly the only) indicator of value, at least for some species.	Duckhunt

Hydro Regime	0.46	AVERAGE(ISOwet, SatPct, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro12
Structure	0.20	AVERAGE[Interspers, AVERAGE(ABpct, EmPct), AreaTotal]	Struc12
Productivity	0.31	AVERAGE(Wettype, Acidity,Warmth, Fringe, Lake, Fish, Algae, TidalProx, Gradient)	Produc12
Landscape		IF((Fen+Marsh=0), blank, ELSE: AVERAGE(WetTypeDiv, Beaver, PondProx, BigPondProx)	Lscape12
Stressors (lack of)	1.00	AVERAGE(Corea, Coreb, BMP, _Tox)	Stress12

Function Score for Feeding Waterbird Habitat	F	4.37	IF((AllSat1=1),0, IF((TooSmall=1),0, IF((TooSteep=1), 0, ELSE: [AVERAGE(Lscape,Stressors, Produc) + 2*MAX(Mudflat, AVERAGE(Hydro, Struc)] /3
Benefits Score for Feeding Waterbird Habitat	B	3.33	IF((Rare=1),1, IF((IBirdv=1),1, MAX(HerbUniq, DistPond, AVERAGE(DuckHunt, PopCtr, Visib))))

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Waterbird Nesting Habitat		The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	WBN					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.00	Larger wetlands in this region are used disproportionately by nesting waterbirds (Gibbs et al. 1991, Stevens et al. 2003). Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex. Larger areas also are preferred by many waterbird species as roosting or molting sites, because they provide greater buffer against predators. Larger wetlands also are more likely to have productive fish populations, and may be sufficiently long for some waterbird species (e.g., cormorants, loons) that require lengthy areas when taking flight.	SizeHerbac 13
		<0.01 hectare (about 10 m x 10 m).	1	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Road corridors are often followed by ravens and mammals that prey on waterbird eggs and young, and fledglings are vulnerable to collisions with vehicles.	RdDis13
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	8	8			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:					Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Corridors can be important to ducks that must walk overland with their young to find other wetlands in which to feed or molt. Nesting waterbird richness in this region is depressed more by isolation when that occurs in small than in large wetlands (Gibbs et al. 1991).	PondProx13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:					Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is partly because they provide greater buffer against predators, are more likely to have productive fish populations, and are long enough for waterbird species that cannot take flight by leaping directly upward (Stevens et al. 2003). Duckling survival is also greater in or near large ponded water bodies, provided they also have adequate cover. However, motorboat use is greater in some larger water bodies and the disturbance can affect waterbird breeding success.	LakeProx13
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 -2 km.	0	4	0			
		2-5 km.	1	3	0			
		5-10 km.	0	2	0			
		>10 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term.	Toxics13
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Breeding density of some waterbirds can be twice as great in fishless lakes than in lakes with fish, after accounting for lake area, and some species occur almost exclusively in fishless lakes due to greater abundance of aquatic invertebrates upon which they feed (Epners et al. 2010). *In calculations, receives maximum indicator score if wetland has water but is fishless, whereas if fish are present, this indicator is ignored.*	Fish13A
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	1	1	1			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	2	0			
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.	0			0.00	Although not applicable to all nesting waterbird species in this region, the models that predict suitable nesting habitat for black duck are likely to identify and map areas suitable for many. Black duck is a species that has declined in much of its historical range.	Bduck13
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Waterbirds (e.g., black duck, Staicer et al. 1994) raise young most successfully in more productive wetlands, which tend to be marshes along rivers and lakes. However, many fens that contain ponded open water also are heavily used by some nesting waterbird species.	Wettype13
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.00	Large-diameter trees are more important because of their potential to provide rookeries for herons and nest cavities for a few waterbird species, e.g., hooded merganser. Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	TreeForm13
		coniferous, 1-9 cm diameter and >1 m tall.	1	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	0	0			
		coniferous, 10-19 cm diameter.	1	0	0			
		broad-leaved deciduous 10-19 cm diameter.	0	0	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:					Snags provide nest cavities for a few waterbird species, e.g., wood duck, common goldeneye (Prince 1968). Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagB13
		None, or fewer than 8/ hectare which exceed this diameter.	0	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	3	0			
		Several (>8/hectare) but above not true.	1	2	2			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.40	Most waterbirds favor emergent herbaceous vegetation rather than woody vegetation, partly because it provides food as well as cover. Herbaceous rather than woody vegetation is the most attractive nesting cover for most species of waterbirds (Bolenbaugh et al. 2011), partly because it provides food as well as cover. Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008). Even tree-nesting species such as wood duck and goldeneye prefer nest sites with relatively open surroundings (Prince 1968).	EmPct13
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	0	0			
		5-25% of the vegetated part of the AA.	1	2	2			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0			0.00	Open water is important to a wide array of nesting waterbirds, and is most available in "fringe" wetlands. *In calculations, is excluded automatically (cell goes blank) if wetland never has persistent surface water during an average year.*	Fringe13
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Lacustrine wetlands are especially attractive to nesting waterbirds, partly because of the variety of foods they provide, and the refuge that the large expanse of open water provides from terrestrial predators. However, use by some nesting waterbird species may be less if there is frequent motorboat use. In Maine, nesting waterbird richness was less in lacustrine wetlands than other wetland types, but the hosted species (loons, grebes) were less common in other wetland types so the lacustrine wetlands contributed disproportionately to regional bird diversity (Gibbs et al. 1991). *In calculations, presence increases the score but absence has no effect.*	Lacus13a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Most waterbirds require some unflooded shoreline for nesting, while also needing large areas of water and emergent vegetation for feeding.	SatPct13
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.50	Surface water that persists for all or most of a year (and especially, during the early summer) provides more physical habitat for waterbirds. If no surface water persists, waterbird nesting can still be substantial if the wetland borders a lake, large river, or estuary. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct13
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.60	Most waterbirds situate their nests on or near persistent water. However, wetlands that flood only seasonally often provide more food and cover for young. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	4	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	5	0			
		20-50% of the AA.	1	3	3			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Large water level fluctuations during the nesting season (late spring and early summer), can flood the nests of birds that nest along wetland edges. However, annual fluctuations (described here) do not necessarily parallel propensity of water levels to fluctuate during the nesting season, and can stimulate wetland productivity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu13
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Most waterbirds prefer depths of 1- 2 ft. Wetlands with greater depths will nonetheless usually have some portion of their area in this and shallower depth classes. Even the shallowest areas are important to many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth13
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different waterbird species prefer different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 13
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds tend to feed more in ponded areas than along channels. If these isolated pools areas persist well into the summer, they allow waterbird populations to establish more breeding territories within the site, as well as concentrating invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry13
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Marshes with a relatively even mix of open water and emergent vegetation tend to support the most nesting waterbird species in this region (Gibbs et al. 1991, Longcore et al. 2006, Hierl et al. 2007). Emergent and submersed vegetation is an essential food for many duck species, either directly or because of the higher densities of invertebrate foods that it supports (Epners et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov 13
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	2	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Waterbird nests located in narrow wetlands may be more vulnerable to predation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs13
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	A gentle shore slope provides waterbirds with easier access to upland nesting cover near the water (Staicer et al. 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	ShoreSlope 13
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (Typha spp.), common reed (Phragmites), or tall (>1m) bulrush is:				0.00	Tall robust vegetation provides better nesting cover than does shorter vegetation.	EmRobust13
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1	0	0			
		1-25% of the emergent vegetation.	0	2	0			
		25-75% of the emergent vegetation.	0	4	0			
		>75%, of the emergent vegetation.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods (Longcore et al. 2006), and encourages establishment of breeding territories by more individual birds. Use of such wetlands has been shown to be significantly greater (Gibbs et al. 1991). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers13
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0				Waterfowl nests on Islands that are inaccessible to mammalian predators are more successful (Loekmoen & Woodward 1992). *In calculations, is excluded automatically (cell goes blank) if wetland lacks an island, but if island is present, it counts as a positive.*	Island13
F47	pH Measurement	The pH in most of the AA's surface water:					When non-acidic ponds are available, most duck species prefer to nest in those rather than acidic lakes and wetlands (Paquette & Ankney 1996, Epners et al. 2010), and nestling survival of at least one species is less in low-pH wetlands (McAuley & Longcore 1988). Fish-eating waterbirds in this region are most productive when nesting in non-acidic ponds (pH of 5.5 or greater, Parker et al. 1992), but in Maine sometimes nested in lakes that were more acidic (Gibbs et al. 1991). Some nesting waterbird species in Maine seemed unaffected by pond pH (Parker et al. 1992). *In calculations, the indicator score is set to 0 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	Acidic13
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	At least in the short term, open water areas created by beaver dams provide excellent nesting and foraging habitat for several waterbird species (Gabor et al. 2002, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver13
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope wetlands.	Gradient13
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	In herbaceous wetlands, the type of adjoining upland cover is very important to many nesting waterbird species. Most upland-nesting waterfowl nest within about 1000 ft of wetlands. Maintaining mostly non-woody but natural vegetation in such areas makes it difficult for predators to find nests.	BuffNatPct13
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	The type as well as the amount of upland cover near the wetland is important to nesting waterbirds. Impervious surfaces are unusable, whereas some low-intensity rural lands can provide marginally suitable cover. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUtype13
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core1_13
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2_13
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds, and human presence can attract crows and ravens, which prey on nests. Even the simple presence of people on foot and without dogs will cause many waterbirds to take flight. Repeated intrusions that drain the energy of waterbirds are especially damaging during the period when adult birds are searching for food to feed their young.	BMP13
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq13
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of nesting waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare13
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Wetland value is considered greater if it is part of an area recognised officially as being of outstanding importance to waterbirds. Such areas have been chosen through a systematic selection process by biologists and birders in this region and elsewhere.	_IBA13

HydroRegime	0.52	AVERAGE(ISOwet, SatPct, Fluctu, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro13
Structure		AVERAGE[(Interspers, AVERAGE(EmPct, EmRobust, SizeHerbac, Vwidth, AqPlantCov, Snags)]	Struc13
Productivity	0.38	AVERAGE(Wettype, Gradient, Acidity, ShoreSlope, Fish, Island)	Produc13
Waterscape		IF((Fen_ + Marsh=0), blank, ELSE: AVERAGE(Bduck, Lake, LakeProx, Fringe, Beaver, PondProx)]	Wscape
Stressors (lack of)	1.00	AVERAGE(Core1, Core2, BMP, Toxics)	Stressors13
Landscape	0.83	AVERAGE(BuffLUtype, BuffNatPct, RdDis)	Lscape13

Function Score for Nesting Waterbird Habitat	F	3.02	IF((AllSat=1), 0, IF((TooSteep=1),0, IF((TooSmall=1),0, ELSE: [3*AVERAGE(AqPlantCov, SizeHerbac, Wettype,Wscape) +2*AVERAGE(HydroRegime, Structure, Productivity) + AVERAGE(Stressors, Landscape)] / 6
Benefits Score for Nesting Waterbird Habitat	B	3.33	IF((Rare=1),1, IF((IBirdv=1),1, ELSE: MAX(DistPond, HerbUniq)

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Songbird, Raptor, & Mammal Habitat		The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	SBM					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.00	Larger wetlands generally support more bird species than smaller ones (Findlay & Houlahan 1997) as well as being used disproportionately by some species. Smaller identical wetlands of equal cumulative area might support equal or greater cumulative richness of songbirds and mammals, especially if they are close together and connected with corridors of undeveloped land. For predicting bird diversity, some evidence from peatlands (Calme and Desrochers 2000) suggests that wetland size may be less important than microhabitat heterogeneity (which is represented by other indicators).	SizeHerbac 14
		<0.01 hectare (about 10 m x 10 m).	1	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.67	Many songbirds and mammals occur only in larger tracts of natural land cover. Fragmentation of wooded riparian areas by residential development or clearcuts can, over the long term, reduce the diversity of songbirds nesting in the remaining patches (e.g., Smith & Wachob 2006). Breeding wetland birds sometimes do persist in small disturbed wetlands as long as much larger undisturbed wetlands nearby remain productive (e.g., Vermaat et al. 2008). Ideally, no clearing should result in a forest being fragmented into an isolate smaller than about 40 ha or narrower than 50 m, and definitely not smaller than about 1 ha or narrower than 30 m (Donnelly & Marzluff 2004). In the Seattle metro area, Pacific (Winter) Wren occurred mostly in areas with less than 20% surrounding urban cover and forest patch size of more than about 1 ha (Donnelly 2004, Donnelly & Marzluff 2006). Theoretical and limited empirical data suggest that 30% or more forest cover across a large area is the threshold value above which landscapes might provide sufficient habitat and connectivity for many forest species, allowing those species' populations to survive even in small remaining patches (Andren 1994). Minimum patch sizes required for breeding by the most sensitive forest songbirds (e.g., Brown Creeper) may be about 10 ha (Donnelly & Marzluff 2004, Poulin et al. 2008). However, a study in British Columbia old growth forest found patch size had little to do with the abundance or diversity of birds in the forest (Schieck et al. 1995).	NatVegSize 14
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	1	6	6			
		100 to 1000 hectares.	0	7	0			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	9	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.57	Wetlands that are closer to natural land cover and not separated by roads that interfere with movements across the landscape, are more likely to support a large diversity of songbird and mammal species. Forest gaps deter red squirrel movement (Bakker & Van Vuren 2004) and hinder movements of many birds. Nests in wetland forest edges, where both jays and squirrels occur frequently, are depredated more often than those in wetland openings or forest interior, where predators were less common (Desanto & Wilson 2001). The probability that a forest-dwelling bird will fly in the open between two patches of forest decreases rapidly as the distance separating those patches increases (Desrochers & Hannon 1997, St. Clair et al. 1998). Forest bird species usually prefer to detour under forest cover even if the forested route is longer, but if the detour is too long, they will prefer a shortcut across openland. However, when possible most forest bird species avoid venturing farther than about 30 m from a forest edge (St. Clair et al. 1998)	NatVegProx 14
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	7	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.33	The total proportion of the land that is natural land cover, as well as its proximity, can affect songbird and mammal richness in wetlands. Wetlands that contain or are close to natural land cover, and not separated from that by roads that interfere with movements across the landscape, are more likely to support forest-dwelling species (Betts et al. 2007). In Ohio, migrant songbirds had the strongest positive correlation with natural land cover near streams when it was measured within ~250 m of streams, rather than in areas closer or farther. Some migrant songbirds were much less likely to occur where there were many buildings within that distance of streams (Pennington 2008). However, one study found that migrant bird abundance was statistically unrelated to either percent urbanised land or percent forest cover within 1 km.	NatVegPctScape14
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	4	0			
		>90% of the land. SKIP to OF10.	0	6	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type as well as the amount of disturbed upland cover near the wetland is important to mammals and nesting songbirds. For most species, impervious surfaces are unusable. Habitat gaps caused by placement of roads, driveways, or homes – as well as by natural features such as wide tidal channels -- can impact movements of mammals and birds (Trombulak & Frissell 2000, Ortega & Capen 2002). This is especially true when the gaps are wider than about 30 m (Rich et al. 1994, Rail et al. 1997, St. Clair et al. 1998, Belisle & Desrochers 2002, Tremblay & St. Clair 2010), and definitely when wider than 60 m (Creegan & Osborne 2005, Bosschieter & Goedhart 2005, Awade & Metzger 2008, Lees & Peres 2009). Species that prefer low vegetation may be particularly reluctant to cross forest clearings. The presence of small clusters of trees scattered within very wide forest gaps may be sufficient to enhance willingness of some forest bird species to cross those gaps (Robertson & Radford 2009).	ScapeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.38	High nest predation occurs on the edges of residential areas because jays and ravens are more abundant there. Nest predation can also be high in clearcut openings. Human settlements are accompanied by an increase in refuse, whether it be illegally dumped trash, recklessly contained household garbage, or well-intended compost piles. These serve as a food for ravens that prey extensively on native songbirds, frogs, and other wildlife (Chace & Walsh 2006). Crow populations have been shown to increase up to at least 1 km from new urban areas (Oneal & Rotenberry 2009).	PopCtr14
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	1	3	3			
		1 - 5 km.	0	5	0			
		>5 km.	0	8	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Traffic poses a hazard to songbirds and mammals that attempt to cross roads (Forman et al. 2002, Clevenger et al. 2003, Massey et al. 2008, Minor & Urban 2010, Tremblay & St. Clair 2010, and see reviews by Fahrig & Rytwinski 2009, Benitez-Lopez et al. 2010). Roadsides also may channel the movements of predators. Noise from heavy traffic interferes with bird reproduction because some birds cannot hear singing of prospective mates (Wood & Yezerinac 2006, Slabbekoorn & Ripmeester 2008, Barber et al. 2010) and road noise can restrict habitat use by bats (Schaub et al. 2008) and moose (Snaith et al. 2002).	DisRd14
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	0	6	0			
		>500 m.	1	8	8			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	Roads that completely encircle a wetland limit the access to the wetland by upland mammals, and may isolate small mammal populations within the wetlands. To sustain most forest-dwelling bird species, linear clearings should cause no gap in the forest canopy wider than about 30 m (Belisle & Desrochers 2002, Tremblay & St. Clair 2010). Roads also tend to concentrate nest predators.	RdBox 14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.57	Many wetland songbirds and mammals may prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can use alternate sites which may provide different but complementary types of food and cover. Corridors can be important to small mammals moving between wetlands.	PondProx 14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF16	Upland Edge Contact	Select one:				1.00	When wetland perimeter mostly adjoins upland rather than more wetland, this allows animals to move more conveniently between uplands and wetlands, benefitting from resources in each. In particular, small mammals avoid wetter (usually more central) parts of wetlands in favor of drier edges (Mazerolle et al. 2001).	UpEdge14
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1			1.00	Although hardly representative of the needs of all wetland-dependent songbirds and mammals, the presence of suitable wintering habitat for deer is an important component of this function. However, very high deer densities reduce habitat for ground- and understory-nesting birds.	DeerHab14
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of songbird and raptor species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv14
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95% , 5 if 75-95% , 4 if 50-75% , 3 if 25-50% , 2 if 5-25% , 1 if <5% , 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100% .	2			0.33	Songbird richness within a site is strongly associated with a diversity of height classes, combined with a mix of conifer and deciduous trees/shrubs in each height class. Trees and shrubs support a wider diversity of songbirds, raptors, and mammals than does herbaceous vegetation, partly because they provide more vertical structure and produce downed wood and snags that have other habitat benefits. Trees help shelter the water in wetlands from high winds, facilitating the aerial foraging activities of birds and bats (Whitaker et al. 2000). *In calculations, the indicator score is based on number of height-form classes (of a possible 6).*	WoodyHtDiv14
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					Lack of one dominant shrub species suggests higher shrub richness, which has the potential to provide more food sources to more species throughout a season. *In calculations, is excluded automatically (cell goes blank) if wetland has <5% shrub cover. If second choice is marked this indicator is scored as a 1 but if first choice is marked this indicator is ignored in model calculations.*	ShrubDiv14
		those species together comprise > 50% of such cover.	1	1	1			
		those species together do not comprise > 50% of such cover.	0	2	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.38	Tree cavities needed by many nesting songbirds and mammals are found mostly in dead standing trees (snags) and larger-diameter trees. Larger-diameter stands also tend to be older and provide more structure useful to a variety of songbirds and mammals. Taller snags are especially useful to raptors as hunting perches. A mixture of tree species, especially mixtures that include aspen, is necessary to sustain populations of most boreal woodpecker species (Drever & Martin 2010). Deer need a diversity of forest types and ages (both early succession and old growth) near each other within their home ranges (Chang et al. 1995), as do moose (Snaith et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The indicator score is based equally on the proportion of classes present and their weighted average.*	TreeTypes 14
		coniferous, 1-9 cm diameter and >1 m tall.	1	1	1			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	3	3			
		coniferous, 10-19 cm diameter.	1	2	2			
		broad-leaved deciduous 10-19 cm diameter.	0	4	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				1.00	Interspersion of woody cover with food-rich openings of herbaceous vegetation provides greater feeding opportunities for many songbirds and mammals, and is a natural phenomenon caused by windthrow and other factors in forested wetlands. In British Columbia, activity levels of bats were more than 40 times greater in riparian than in upland areas, due to greater abundance of emerging aquatic insects, and were significantly greater where stand complexity and extent of forest edges was greater. Gaps of 3-10 trees in an otherwise forested matrix , that comprise about 30% of the matrix , resemble most closely the conditions in mature forest of Vancouver island, BC (Lertzman et al. 1964). Most canopy gaps occupy 50-200 m2 and a diameter-height ratio is typically <0.50 (Ott & Juday 2002). Excessive gap frequencies and areas (i.e., forest fragmentation) and lack of corridors that connect forested wetlands with upland forests can be detrimental to some species if the remaining forested patches are very small. *In calculations, is excluded automatically (cell goes blank) if wetland has little or no woody cover.*	WoodPatt14
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70% . Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:				1.00	Tree cavities are needed by many nesting songbirds (Drapeau et al. 2009) and mammals such as roosting bats (Grindal & Brigham 1999, Grindal et al. 1999). Tall snags are especially useful to raptors as hunting perches. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagsD14
		None, or fewer than 8/ hectare which exceed this diameter.	0	1	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	2	0			
		Several (>8/hectare) but above not true.	1	2	2			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides cover for many small mammals. Downed wood is often the result of natural windthrow, which also creates small patches of semi-open canopy within blocks of forest and in so doing can support a larger number of wildlife species, despite the temporary loss of nest trees (Zmihorski 2010). In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown 14
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1	1	1			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Due to fertilizing effects of its nitrogen-fixing capacity, alder can increase the abundance of forbs important to songbirds and other wildlife.	Nfix 14
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Although scattered open spots provide feeding opportunities for some species, most ground-nesting songbirds and mammals prefer dense ground cover as concealment from predators. Thinning of ground cover by high densities of deer can impact songbirds (Thiemann et al. 2009, Martin et al. 2010).	Gcover14
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	5	5			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Complex microtopography reflects and provides more extensive habitat for small mammals and some songbirds.	Girreg14
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F13	Upland Inclusions	Within the AA, inclusions of upland are:				0.50	Wetlands with upland inclusions allow animals to move more conveniently between uplands and wetlands, using resources in each.	Inclus14
		Few or none.	0	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	1	1	1			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.50	Most songbirds prefer to nest in drier parts of wetlands because ground cover and vegetation height, which provide essential structure, tend to be greater there.	SatPct14
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	4	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	6	0			
		99-100% . AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				1.00	Parts of wetlands that remain flooded most of the time will support fewer small mammals and songbirds due to lack of vertical structural complexity. Wetlands with at least a little persistent water are important to aerially-foraging swallows, swifts, and flycatchers, as well as bats, muskrat, beaver, moose, and many other mammals. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct14
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	3	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider vegetated zones within wetlands provide more nesting space and structure for songbirds and mammals. Wider riparian buffers in British Columbia supported a greater density of deciduous trees important to wildlife diversity in that region (Shirley 2004). Also in British Columbia, even buffers of 150 m failed to support several species at densities equivalent to those in extensive uncut forests: Brown Creeper, Pileated Woodpecker, Golden-crowned Kinglet. However, at least 2 species – Warbling Vireo and Swainson's Thrush – were more common in buffers than in uncut forest (Shirley & Smith 2005). The diversity of microhabitats within bogs and fens generally increases with increasing area, and vertebrate richness consequently increases (Desrochers & van Duinen 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth14
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					When water and vegetation (especially woody or other robust vegetation) are moderately interspersed, this provides more extensive feeding areas for many wetland-dependent songbirds and raptors. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers14
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver impoundments, especially after they are abandoned and revert to early successional shrubs, support higher bird species richness than many other land cover types (Grover & Baldassarre 1995, Aznar & Desrochers 2008) and are also important to river otter (LeBlanc et al. 2007, Gallant et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver14
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.40	To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts & Forbes 2005). However, riparian buffer strips 50 m wide were insufficient to maintain nesting forest interior songbird species in Newfoundland (Whitaker & Montevecchi 1999).	BuffPerim14
		<5% .	0	0	0			
		5 to 30% .	0	1	0			
		30 to 60% .	1	2	2			
		60 to 90% .	0	4	0			
		>90% , or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Small mammals moving between wetlands are less likely to have their movements disrupted by lands with residual cover than in lands with impervious surface, but both are capable of hindering dispersal (Flaherty et al. 2008). *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	CUtypeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Some of these features are important to bank-living beavers, swallows, and swifts. *If present this indicator is scored as a 1 but if absent this indicator is ignored in model calculations.*	Cliffs14
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Human presence can attract crows and ravens which prey on nests. Dogs and house cats that prey on wetland songbirds and mammals also tend to be more prevalent in areas frequently visited by humans.	Core14a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95% , with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core14b
		<5% . If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	3	3			
		5-50% .	0	2	0			
		50-95% .	0	1	0			
		>95% of the AA.	0	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of songbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq14
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of songbirds on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq 14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of wetland-associated songbirds, raptors, and mammals on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1			1.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to songbird biodiversity at a regional scale. In New Brunswick, wetlands are used to a greater extent than other habitats by the bird species identified as being of highest conservation concern (Environment Canada 2013).	Rare14
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	These areas were designated based on a rigorous nomination and screening process by ornithologists.	_IBA14

StructureA	1.00	AVERAGE (Gcover, Girreg, Cliffs, SnagsD, WoodDown, DeerHab)	StrucA
StructureB		AVERAGE (WoodyHtDiv, ShrubDiv, WoodPatt, TreeTypes)	StrucB
Productivity	0.15	(AVERAGE(SizeHerbac, Vwidth))*((AVERAGE(Nfix , Inclus, UpEdge, Hardwd)))	Produc
Landscape	0.57	AVERAGE (WetTypeDiv, CUbuffNatPct, CUtypeLU, NatVegProx , NatVegPctScape, ScapeLU, NatVegSize)	Lscape14
Waterscape	0.77	AVERAGE (SatPct, PermWpct, PondProx , Beaver, Interspers)	Wscape14
Stressors (Lack of)	0.68	AVERAGE (CoreA, CoreB, BuffPerim, PopCtr, RdBox , DisRd)	Stress14

Function Score for Songbird, Raptor, & Mammal Habitat	F	8.16	IF((AllWater=1),0, ELSE: (AVERAGE(PermWpct, AVERAGE(StrucA, StrucB, Produc, Lscape, Wscape, Stress))
Benefits Score for Songbird, Raptor, & Mammal Habitat	B	10.00	IF((Rare=1),1, IF((IBA=1),1, ELSE: MAX(HerbUniq, WoodyUniq, DistPond)

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Pollinator Habitat		The capacity to support a diversity or abundance of pollinating insects, such as bees, wasps, flies, butterflies, moths, and beetles.	POL					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.50	Native pollinators are most abundant and diverse where naturally vegetated areas are nearby. Distance to such areas is often a strong predictor (Westphal et al. 2006, Ricketts et al. 2008, Garibaldi et al. 2011). However, the minimum size of such patches that is capable of influencing pollinators is unknown.	DistNat0
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	6	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.50	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded by a large proportion of unmanaged vegetation (Savage et al. 2011, Kennedy et al. 2013, Moisan-Deserres et al. 2014b, Cutler et al. 2015).	CovPct Scape0
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	3	0			
		>90% of the land. SKIP to OF10.	0	4	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				0.80	Among woody plants, low shrubs such as blueberry and current tend to be the most common sources of pollen for pollinating insects, and are most dependent on insects for pollination. *In calculations, the woody plant height and form that is most favoured by pollinators (column E) and is most predominant (column D) is identified automatically and placed on the 0 to 1 scale.*	WoodyHt Form0
		coniferous trees (may include tamarack) taller than 3 m.	2	0	0	8		
		deciduous trees taller than 3 m.	1	1	1			
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1	3	3			
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	2	4	8			
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1	5	5			
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1	5	5			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					A wider variety of woody plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	ShrubDiv0
		those species together comprise > 50% of such cover.	1	1	1			
		those species together do not comprise > 50% of such cover.	0	0	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.31	A mix of diameter classes may indicate a wider variety of woody species available for pollination. The formula gives equal weight to the variety of classes and increasing mean diameter. Deciduous trees allow more light penetration and thus tend to support more flowering plants in the understory. Larger trees provide more deadwood for bee and wasp colonies. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The score is based equally on the proportion of classes present and their weighted average.*	woodydbh0
		coniferous, 1-9 cm diameter and >1 m tall.	1	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	1	2	2			
		broad-leaved deciduous 10-19 cm diameter.	0	3	0			
		coniferous, 20-40 cm diameter.	0	4	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:				1.00	Dead wood provides critical nesting habitat for many pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	Sngs0
		None, or fewer than 8/ hectare which exceed this diameter.	0	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	1	0			
		Several (>8/hectare) but above not true.	1	1	1			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:				1.00	Downed wood provides nest sites and shelter for some pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	downwood0
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	1	1	1			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	A small proportion of bare earth is important to some burrowing pollinators, but too much is at the expense of plants that provide pollen (Moisan-Deserres et al. 2014a).	gcover0
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	1	1			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	3	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Many pollinating species depend on such microtopographic features for nest sites and cover.	girreg0
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:				0.25	Flowers from forbs provide the most opportunities for a diverse array of pollinator species, but some graminoids (e.g., native bunchgrasses) are used as well.	Forbs0
		<5% of the herbaceous part of the AA.	0	0	0			
		5-25% of the herbaceous part of the AA.	1	1	1			
		25-50% of the herbaceous part of the AA.	0	2	0			
		50-95% of the herbaceous part of the AA.	0	3	0			
		>95% of the herbaceous part of the AA.	0	4	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	A wider variety of herbaceous plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	herbdiv0
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Although some non-native plants attract pollinators, many of those plants tend to be invasive, reducing the overall diversity of plant species available for pollination at different times of the season (Thijs et al. 2012). A broad seasonal distribution of available pollen and nectar sources is critical to maintaining pollinator diversity.	herbsens0
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Wetlands comprised almost entirely of persistent water usually have much less vegetation cover, so fewer plants per unit area are available to pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	persist0
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				1.00	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded at least partially by, or close to, unmanaged vegetation (Moisan-Deserres et al. 2014b, Cutler et al. 2015).	BuffPerim0
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	3	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	3	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.00	See above. *In calculations, is ignored if >90% of the wetland perimeter has a vegetated buffer. In other situations, the indicator score is set to 0 if impervious but otherwise is ignored in the model calculations.*	BuffLUtype0
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Rocky and other bare areas are more likely to support burrows for pollinator nests and mud for hive construction (Moisan-Deserres et al. 2014a).	cliff0
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.56			0.44	Many pollinators are highly sensitive to some of the pesticides used in this region (e.g., Kevan 1975, Plowright & Rodd 1980, Brittain et al. 2010, Gradish et al. 2012).	Toxic0

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of pollinators on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq0
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of pollinators on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq0
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0			0.00	Pollinators may be especially valuable if the wetland contains a rare plant species dependent on insect pollination (Jones & Klemetti 2012).	RareHerb

Pollen Onsite	0.79	AVERAGE[MAX(WoodyHtForm, Forbs), AVERAGE(herbsens, herbdiv, ShrubDiv)]	PollenOn
NestSites	0.76	AVERAGE[persist, AVERAGE(woodydbh, snags, downwood, girreg, cliff, gcover)]	NestSites
Stressors (lack of)	0.49	AVERAGE(Toxic, CovPctScape, DistNat, BuffPerim, BuffLUtype)	Stress0

Function Score for Pollinator Habitat	F	6.81	IF(AllWet=1), 0, AVERAGE(PollenOnsite, NestSites, Stress)
Benefits Score for Pollinator Habitat	B	3.33	MAX(HerbUniq, WoodyUniq, RareHerb)

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Native Plant Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	PH

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.00	Larger wetlands generally support more plant species than smaller ones (Weiher & Boylen 1994, Findlay & Houlahan 1997, Matthews 2004, Houlahan et al. 2006) although in some landscapes, smaller identical wetlands of equal cumulative area support equal or greater cumulative richness of plants (Peintinger et al. 2003).	SizePD
		<0.01 hectare (about 10 m x 10 m).	1	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.63	Although urbanization typically reduces the diversity of plants in the forest understory, plant community composition in a Wisconsin study was better explained by the amount of surrounding forest than by environmental factors within the studied forests (Rogers et al. 2009). A leveling off of the plant species-area accumulation curve in Alberta forests appeared at a forest patch size of about 10 ha (Gignac & Dale 2007). A study in Washington found that forest patches as small as 1 ha, if not narrow, may be large enough to have a microclimate supportive of most plants and animals (Heithecker & Halperin 2007). Depending on their shape, forest patches sised about 4 ha or larger may provide habitat capable of sustaining a diverse array of bryophyte functional groups in temperate rainforest landscapes (Baldwin & Bradfield 2007).	SizeVeg Connec15
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	1	5	5			
		100 to 1000 hectares.	0	6	0			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.50	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006).	DistBig15
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	6	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.50	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006). However, one study found that forested wetlands in developed landscapes had community composition and structure similar to those in undeveloped landscapes, with number of exotic species being no greater (Ehrenfeld 2005)	VegPct5k15
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	3	0			
		>90% of the land. SKIP to OF10.	0	4	0			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.50	Non-native plants that can reduce native plant richness tend to be more prevalent closer to population centers because many have been introduced intentionally or unintentionally by humans.	PopCtr15
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	1	3	3			
		1 - 5 km.	0	4	0			
		>5 km.	0	6	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Road corridors are a significant vector for non-native plants that can reduce native plant richness if they invade nearby wetlands.	DistRdPD
		<10 m.	0	0	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	5	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	6	6			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.50	Wetlands that are more geographically isolated from each other may be likely to have lower plant species richness than those close together (Nekola 1999).	PondProx15
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Wetlands, especially bogs, that are ice-free for longer during the year, as inferred from growing degree days, tend to have more plant species (Glaser 1992).	GDDpd
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			1.00	Many species which contribute disproportionately to regional biodiversity due to their rarity occur in areas of limestone (calcareous) bedrock and soils, and not where exposure to acid precipitation is great. This indicator is ignored in calculations unless calcareous soils or bedrock are present or site is in a region where exposure to acid precipitation is relatively limited.	Karst16a

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	2			0.33	Plant species richness within a site may be broadly associated with a diversity of height classes, especially if combined with a mix of conifer and deciduous trees/shrubs in each height class (Brandt et al. 2015). *Score is based on number of height-form classes (of a possible 6) that are present.*	WoodyHtDiv15
F3A	Deciduous Woody Cover		2			0.33	Deciduous cover allows more light to penetrate to the ground than does evergreen cover. In many instances this results in greater richness of understory plant species. *In calculations, is excluded automatically (cell goes blank) if few or no trees are present. Score is based on maximum deciduous cover in either the shrub (1-3 m) or tree (>3 m) categories.*	DecidCov15
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:				0.00	A dominance of common species usually implies overall reduction in plant species richness. Although shrubs contribute to onsite plant diversity, wetland shrub communities are generally less diverse than herbaceous plant communities in wetlands. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodSpDom15
		those species together comprise > 50% of such cover.	1	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				1.00	Wetland plant species richness often correlates positively with presence of a relatively even and dispersed mix of herbaceous and woody vegetation within the wetland (Brandt et al. 2015). Sparse woody cover sometimes indicates overgrazing by deer, which reduces plant diversity (Thiemann et al. 2009, Martin et al. 2010). *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	WoodHerbMix15
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.67	Red alder often occurs in mildly disturbed settings, and through its ability to increase soil fertility by fixing nitrogen, can increase the cover and perhaps the diversity of understory plants. However, as alder stands age, they form a closed canopy which can block light and reduce understory plant richness.	NfixPD
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	2	2			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Different plant species occur under different moisture regimes, which correlate with different elevations (Samoni et al. 2010), so a greater diversity of elevations (i.e., complex microtopography) often supports a wider variety of plants. Adding small ridges and furrows to constructed depressional wetlands was found in one study to increase their percent cover of obligate wetland species (Alsfeld et al. 2009). Wetlands with more varied topography tended to have greater plant species richness because this creates different flood frequencies within the wetland (Pollack et al. 1998).	GirregPD
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.50	Coarse soils tend to be less productive and in some cases this results in reduced species richness of wetland plants. Wetland soils with higher organic content often support greater plant species richness (e.g., Alsfeld et al. 2009).	SoilTexPD
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	0	2	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Wetlands not dominated by one or two plant species are generally more diverse (e.g., Houlahan & Findlay 2004). *In calculations, is excluded automatically (cell goes blank) if little or no exposed herbaceous cover is present.*	herbdom15
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Invasion by non-native species often reduces native plant species richness (Zedler & Kercher 2004, Schooler et al. 2006) but not always (Houlahan & Findlay 2004). In some regions, a change of only 10 cm in mean water level or a change of only 2 cm in the degree of fluctuation may cause a shift from native to non-native species (Magee & Kentula 2005).	Invas15
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			InvasDom1
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				1.00	Although not all invasive upland plants are capable of establishing sustained populations in wetlands, many can. When they do they reduce plant diversity.	WeedSourcePD
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	4	4			
		some (but <5%) of the upland edge.	0	3	0			
		5-50% of the upland edge.	0	2	0			
		most (>50%) of the upland edge.	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.75	More plant species occur in drier parts of wetlands than in parts that remain flooded for long duration. However, long duration flooding adds some aquatic species not otherwise found in wetlands.	SatPct15
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	1	3	3			
		50-75% of the AA never contains surface water.	0	4	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	3	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	In many regions, wetlands with extensive seasonal flooding tend to have greater plant species richness (Pollack et al. 1998). Seasonal inundation brings in external nutrients to riverine wetlands, and in all wetlands is necessary for seed germination of many wetland plant species. For determining the number of plants and number of species that germinate, the monthly timing of first soil moistening may be more important than the duration of the pre-inundation moist period or the length of inundation (Bliss & Zedler 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpctPD
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	1	2	2			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Wetlands with naturally fluctuating water levels tend to have greater plant species richness, at least in Southeast Alaska floodplains (Pollack et al. 1998). Duration, frequency, and timing of inundation may be more important than magnitude of fluctuation, but cannot be estimated during a single visit to an ungaged wetland. Prolonged deep flooding can reduce plant species richness (Bayley & Guimond 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	FlucPD
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	2	0			
		>2 m change.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	With regard to submersed aquatic plants, shallower areas generally have greater plant richness due to greater availability of light and sediment oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth15
		<10 cm deep (but >0).	0	6	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wetlands with wider vegetated areas are more likely to contain more plant species and rarer and more sensitive plants, as well as being more insulated from some upland disturbances (Rooney & Bayley 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthPD
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Relatively even mixes of emergent plants and open water imply that both submerged aquatics and emergents may be present, thus comprising greater diversity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	IntersperPD
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Inflowing streams bring plant propagules that can sprout and diversify wetland plant communities. Wetlands with surface water connections also tend to be more fertile, although suspended silt can reduce submerged aquatic plants.	InflowPD
F47	pH Measurement	The pH in most of the AA's surface water:					Acidity (pH) influences the species composition, diversity, and productivity of plants within this region's wetlands (Catling et al. 1986, Mullen et al. 2000). Although acidic wetlands tend to be less fertile, they often are the most diverse (e.g., Woodcock et al. 2005). Especially when located near the coast, they often contain plant species that are regionally rare because they cannot withstand the competition present in less acidic, more fertile wetlands that occur more widely (Moore et al. 1989). However, acidic lakes that are naturally stained by tannins ("brownwater lakes") have fewer submersed aquatic plant species because the stained water reduces underwater light (Kerekes & Freedman 1989). *If pH is <5.5, the indicator score is set to 1. Otherwise, this indicator is ignored in calculations.*	Acidic20
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Nutrients, as represented indirectly by conductivity and/or TDS, directly influence the species composition (Srivastava et al. 1995), diversity, and productivity of plants within this region's wetlands, perhaps to a greater degree than acidity. In nearby regions, plant species richness in wetland quadrats declined with increasing nitrate and phosphorus (Houlahan et al. 2006), especially when conductivity exceeded ~400 µS/cm (Johnson & Leopold 1994). *In calculations, the score is set to 1 if TDS exceeds 220 mg/L or conductivity exceeds 400 uS/cm). In calculations, indicator is ignored if any other condition exists.*	Conduc20
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver impoundments increase richness of wetland plants locally, especially a few years after they are abandoned (Pollock et al. 1998, Wright et al. 2002, 2003; Gallant et al. 2004, Bayley & Guimond 2008, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	BeaverPD
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Partly because of the greater nutrient levels and relative hydrologic stability of most groundwater (Langlois et al. 2015), several plant species thrive best where a wetland's surface water originates most directly from groundwater (e.g., Radies et al. 2009). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	GWpd
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Lichens and mosses have been affected by edge-induced microclimate changes extending at least 50 ft into forested areas (Hylander et al. 2002, Boudreault et al. 2008) and as far as ~150 ft from the forest edge (Baldwin & Bradfield 2005). In Oregon, selective thinning of forests that adjoined riparian buffers did not affect the herbaceous or shrub cover in the buffers when they were wider than ~50 ft (Anderson & Meleason 2009). Thinning can increase the distance seeds disperse into the forest and the number that disperse successfully (Cadenasso et al. 2001). One study found that where more than 50% of the basal area was cut, a significantly different plant community structure resulted. Partial cutting did not significantly change abundance for most of the important forage species for deer.	NatVegCApd
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Some types of surrounding land cover are more likely to produce propagules of invasive plants that may reduce native plant richness in an adjoining wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUpd
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F57	Burn History	More than 1% of the AA's previously vegetated area:					At least in herbaceous wetlands, infrequent moderate-intensity fires diversify the herbaceous plant community, partly by releasing nutrients bound in soils and vegetation, and reducing shade and competition (e.g., de Szalay & Resh 1997).	Burn20
		Burned within past 5 years.	0	4	0			
		Burned 6-10 years ago.	0	3	0			
		Burned 11-30 years ago.	0	2	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	1	1			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan- dardise	Rationales	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Seeds of non-native plants commonly are carried by humans and their pets. Non-native plants can decrease plant species richness of the wetland. In the Kenai Peninsula of Alaska,significantly fewer nonnative species were found beyond a 500-m distance from a trailhead. High-use trails, especially those in open-canopied areas, exhibited the greatest numbers of nonnative species at the farthest distances from the trailhead and contained a greater number of less common nonnative species.	Core1pd
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2pd
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	3	3			
		5-50%.	0	2	0			
		50-95%.	0	1	0			
		>95% of the AA.	0	0	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0				Trampling of native vegetation by recreationists can decrease seed germination and increase vulnerability to invasion by more tolerant invasive plants and ultimately reduce native plant richness. These and other Best Management Practices (BMPs) potentially reduce such damage.	BMPsoils20
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0				Calcareous fens often support more plant species than other wetlands of similar size, and the species they support are usually among the regionally rarest (Hinds 1983, Hill & Keddy 1992, Mullen et al. 2000, Hinds 2000, McClellan et al. 2003).	CalcFen15
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	The germination of many plant species is triggered by the interaction of water conditions and season (light). Homogenization or alteration of the natural water regime can thus encourage invasive species at the expense of native flora (Zedler & Kercher 2004, Catford et al. 2011). Inundation at aberrant times of the year can reduce native plant diversity because most native species have evolved in close synchronization with natural seasonal water regimes. Any development that involves increasing the area of lawn or impervious surface is likely to increase runoff amount and concentrate it within shorter time periods, i.e. "pulses" "flashiness" (Booth & Jackson 1997, Booth et al. 2002, DeGasperi et al. 2009). This makes wetlands more susceptible to invasion by non-native plants (Magee & Kentula 2005). *In calculations, is excluded automatically (cell goes blank) if wetland has no surface water inflow.*	AltTime20
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.56			0.44	Increased dominance by fewer species, such as cattail and various invasive plants, often results from increased salinity in normally non-saline wetlands, and results in decreased native plant richness (Gleason & Euliss 1998).	Salt20
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.08			0.92	Deposition of only 0.25 to 0.5 centimeter of new sediment has been shown to significantly reduce species richness, emergence, and germination of wetland plants (Gleason et al. 2001),	SedDep20
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.50			0.50	Even if vegetation is not removed, compaction of winter snow cover can damage vegetation (Keddy et al. 1979), and compaction of soil can inhibit plant growth by decreasing soil oxygen and altering drainage patterns. Soil disturbance also facilitates invasion by exotic species, and sedimentation limits the germination and growth of wetland plants (Wardrop & Brooks 1998, Mahaney et al. 2005).	SedDisturb20
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan- dardise**	**Rationale**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of herbaceous plant species on wetlands increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq20
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of woody plant species on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq20
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0			0.00	These wetland species are particularly valued because of their rarity and/or declining populations as listed by agencies.	RarePsp20
	Function Score for Pollinator Habitat					0.68	Wetlands with greater plant richness are likely to be more valuable to pollinators if other factors already suggest the wetland has high capacity to support pollinators.	ScorePOLf
	Function Score for Songbird, Raptor, & Mammal Habitat					0.82	Wetlands with greater plant richness are likely to be more valuable to supporting a variety of songbirds and mammals if other factors already suggest the wetland has high capacity to support those.	ScoreSBM

Species - Area	0.47	AVERAGE (Width, Size, SizeVegConn, SatPct)	SppArea
Landscape	0.67	AVERAGE (Beaver, NatVegCA, BuffLUpd, PondScape, PondProx)	Lscape
Aquatic Fertility	0.51	AVERAGE [MAX(CalcFen, Conduc, Acidic), Inflow, AVERAGE (Interspers, Fluc, SeasWpct, Groundw, Depth)]	AqFertilPD
Terrestrial Fertility	0.43	AVERAGE (Nfix, SoilTex, Karst, GDD)	TerrFertilPD
Competition/ Light	0.83	AVERAGE[Invas, AVERAGE(DecidCov, WoodyHtDiv, WoodHerbMix, HerbDom, Burn, Girreg)]	CompetPD
Stressors	0.73	[AVERAGE (Core1, Core2, BMPsoils, WeedSource) + AVERAGE(PopCtr, DistRd) + MIN(AltTime, Salt, SedDep, SedDisturb)]/3	StressPD

Function Score for Native Plant Habitat	F	5.89	IF((InvasDom1=1), 0, ELSE: (4*SppArea + 3*CompetPD + 2*AqFertilPD + 2*TerrFertilPD + LscapePD + StressPD)/13)
Benefits Score for Native Plant Habitat	B	6.10	IF((RarePlant=1),1, ELSE: AVERAGE(SBMscore, MAX(HerbUniq, WoodyUniq), ScorePOL)

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Public Use & Recognition	Prior designation of the wetland, by a natural resource or environmental protection agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research. The model assigns higher scores to greater visitor use. It does not account for some areas being valued more highly (e.g., as wilderness) because they have fewer visitors.	PU

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.40	If accessible, wetlands closer to population centers are likely to be visited by more people on foot.	PopCtrDisPU
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	1	2	2			
		1 - 5 km.	0	1	0			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.13	The frequency of most recreational visits declines with increasing distance from roads.	DistRdPU
		<10 m.	0	8	0			
		10 - 25 m.	0	5	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	3	0			
		100 - 500 m.	0	2	0			
		>500 m.	1	1	1			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	People are naturally drawn to this region's coastal shorelines for recreation and occasionally for relief from summer heat.	TidalProxPU
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0			0.00	This reflects more widespread recognition of particular wetlands or their surroundings.	ConsDesig1
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0			0.00	Prior public investment for these purposes requires greater protection.	ConsInvest
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Mitigation wetlands represent an investment of funds in the public's interest, which should not be wasted.	MitigaSite
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Collection of long term data from wetlands is in the public interest partly because it can lead to more effective and fair regulations.	SciUse
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				0.25	Public ownership generally implies greater public use.	Ownership
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	4	0			
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0			
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	2	0			
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	1	1			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				*In calculations, if wetland is associated with a lake it counts positively; if not, this indicator is ignored in the calculations.*	LakePU
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				0.00	Public enjoyment of wetlands is assumed to be greater when most of the wetland can be seen without obstruction by dense shrubs or other features.	Visibility
		<25%.	1	0	0			
		25-50%.	0	1	0			
		>50%.	0	2	0			
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.33	Lack of physical barriers, provision of trails, and interpretive signs encourage greater public use of areas. However, some apparent barriers (e.g., deep water, dense brush) may be barriers only to summer recreation; frozen wetlands may enjoy considerable wintertime use.	RecreaPot
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	0	1				
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1				
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1				
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	The portion of a wetland that is accessible to visitors is assumed to be an important determinant of frequence of visitation	Core1PU
		<5% and no inhabited building is within 100 m of the AA.	0	4	0			
		<5% and inhabited building is within 100 m of the AA.	0	5	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	3	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.00	See above.	Core2PU
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	0	0			
		5-50%.	0	1	0			
		50-95%.	0	2	0			
		>95% of the AA.	0	3	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0				Such features and practices minimize damage to plants and wildlife and thus help sustain the natural features that attract people to wetlands.	BMPsoilsPU
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				See above.	BMPwildPU

Convenience	0.16	AVERAGE(Ownership, Visibility, RdDist, Core1PU, Core2PU, ElevPU, PopCtrDisPU, TidalProxPU)	Conven
Investment	0.00	MAX(MitigaSite, ConsInvest, ConsDesig, SciUse)	Invest
Recreation Potential	0.33	AVERAGE(RecreaPoten, BMPsoils, BMPwildlife, LakePU)	RecPot

Benefits Score for Public Use & Recognition	B	1.64	AVERAGE(Convenience, Invest, RecPot)

Wetland Ecological Condition	The integrity or health of a wetland, as defined operationally by its vegetation composition and richness of native species. More broadly, the similarity of a wetland's structure, composition, and function with that of a reference wetland of the same type and landscape setting, operating within the bounds of natural or historical disturbance regimes (Adamus 1996).	EC

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				0.63	Rare native species are usually the first to disappear after a wetland is subjected to alteration of its water quality, hydrologic connectivity, or normal water or sediment regimes. Thus, their absence is sometimes indicative of past or ongoing impacts to the wetland's processes and condition.	RareAll
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0	1	0			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Lack of vegetative cover suggests a wetland may be in poor condition as a result of human-related impacts, but could also be the result of natural limitations or events.	BareGpct
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0					
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Under natural unimpacted conditions, many but not all wetlands will have extensive microtopography.	GirregCQ
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Strong dominance by one or a few species, even if those are natives, is sometimes an indicator of impaired ecological condition. However, newly created wetlands often have high richness of colonizing species. *In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.*	HerbDom1
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Alteration of a wetland's water quality or its normal water or sediment regime is usually followed by invasion by non-native species, making these an indicator of past or ongoing alteration.	EmSens1_C
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				The model considers the presence (1) of this condition to indicate a somewhat degraded condition, but does not consider the absence (0) of this indicator a sign that a wetland is necessarily undegraded, so *if the condition is absent, the score is changed to blank and is not used by the model.*	OverRich

Score for Wetland Ecological Condition (Integrity)	EC	10.00	(MAX(RareAll, EmSens) + AVERAGE(HerbDom, GirregCQ, OverRich, BareGpct))/ 2

Wetland Sensitivity	A wetland's lack of intrinsic resistance and resilience to human and natural stressors (higher score = more sensitive).	Sen

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.60	Larger wetlands have a greater proportional area that is buffered against external disturbances and thus may be considered less sensitive. Small wetlands or more vulnerable to drying up as a result of climate change or changes in groundwater flow patterns, and many are poorly-buffered chemically against acifiying chemical inputs from precipitation (Freda 1986).	WetSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	2	0			
		>100 hectares.	0	0	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.00	See above.	NatVegSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	0	3	0			
		100 to 1000 hectares.	0	2	0			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	0	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.50	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if they are contiguous with or close to other natural cover, especially if it is extensive, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegProx_S
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	0	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	1	0			
		50-500 m, and not separated.	0	2	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 5 km, and not separated.	0	4	0			
		0.5 - 5 km, but separated by those features.	0	5	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	6	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.60		VegPctScape_
		<5% of the land.	0	5	0			
		5 to 20% of the land.	0	4	0			
		20 to 60% of the land.	1	3	3			
		60 to 90% of the land.	0	2	0			
		>90% of the land. SKIP to OF10.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.00	See above.	PondProx_S
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	1	0			
		50-500 m, and not separated.	0	2	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	4	0			
		0.5 - 1 km, but separated by those features.	0	5	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	6	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:				0.50	Large water bodies often support high richness of wetland plants and animals, such that if a wetland is distant from a lake, recolonization of the wetland following impacts is likely to be slower.	LakeProx_S
		<100 m.	0	0	0			
		100 m - 1 km.	0	1	0			
		1 -2 km.	0	2	0			
		2-5 km.	1	3	3			
		5-10 km.	0	4	0			
		>10 km.	0	6	0			
OF16	Upland Edge Contact	Select one:				1.00	Longer wetland-upland edge relative to wetland area (i.e., convoluted edge) implies a wetland may be more vulnerable to invasive species, higher evapotranspiration, and other disturbances characteristic of adjoining uplands.	UpEdge_S
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.85	Wetlands near headwaters have less exposure to waterborne colonizing plant propagules, thus potentially longer recovery times and greater sensitivity.	Elev_S

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	The water regimes of wetlands whose catchments are small relative to wetland size are often more precarious and sensitive to landscape alterations (Fitzgerald et al. 2003).	CUratio_S
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetlands in regions with colder temperatures and shorter growing seasons take more time to recover from disturbances, and thus may be considered to be more sensitive.	GDD_S
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				1.00	Individuals belonging to species that are on the margins of their geographic range at this location tend to be more sensitive to some types of environmental disturbances.	RareSpp_S
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0	1	0			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.75	Negative consequences of drought are greatest in peatlands, where large stores of organic matter in soils can be volatilised. Being groundwater dependent, fens are also sensitive to water table changes. Mosses and woody vegetation (shrub and forested wetlands) require many years to fully re-establish if removed or killed, i.e., resilience is less than for herbaceous vegetation. As compared with wooded wetlands, moss wetlands and seasonal marshes receive more off-road vehicle traffic with consequent degradation of soil and vegetation (Loomis & Lieberman 2006). Floodplain wetlands and marshes tend to be better buffered chemically than fens and especially bogs (Wood & Rubec 1989, Wisheu & Keddy 1994). Marshes tend to be more resilient partly because of their relatively high nutrient levels. Fens in some regions tend to be less sensitive to invasion by non-native plants (Magee & Kentula 2005), especially when shaded by a forest canopy. However, they are often highly sensitive to alteration of local water tables (Fitzgerald et al. 2003).	WettypeS
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	3	3			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				0.33	Tree cover is slower to recover than cover of herbaceous plants, making forested wetlands less resilient. *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	TreeCovS
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					Larger-diameter trees are generally older, implying that recovery (resilience) from their loss will take longer than from loss of young trees. Resilience is one component of wetland sensitivity. In calculations, is excluded automatically (cell goes blank) if few or no trees are present.	TreeDBHs
		coniferous, 1-9 cm diameter and >1 m tall.	1	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	0	0			
		coniferous, 10-19 cm diameter.	1	1	1			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:				0.00	Wetlands with fewer species may be less resistant to environmental change, and less resilient following disturbances. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodySens2_
		those species together comprise > 50% of such cover.	1	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				1.00	High dispersion (fragmentation) of woody cover suggests recolonization of wetlands following disturbance may take longer when future disturbances occur, due to less intact corridors with similar cover types. In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.	ShrubPattS
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	1	3	3			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.40	Because of its ability to fertilize soil, alder can speed biological recovery following disturbance [Gomi et al. 2006]. Wetlands without alder may be slower to recover and thus more sensitive.	NfixS
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	2	2			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	5	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.00	If vegetation cover in a wetland is already sparse, it is often more susceptible to further loss from erosion and altered microclimate.	Gcover_S
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	0	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	1	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	2	0			
		Other conditions.	0	3	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.25	Organic soils are particularly sensitive because slight changes in the water table often cause rapid decomposition and/or compaction (subsidence) of this substrate, resulting in major shifts in characteristic plants and animal species as well as biogeochemical processes. Coarse soils are most resistant to compaction, though they are less moisture-retentive and dry out quickly.	SoilTex_S
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Simply because they tend to have more species, wetlands with a predominance of native species have more species to lose and thus could be considered to be more sensitive to impacts. In contrast, once wetlands become dominated by non-native (exotic) species, the plant community structure is simplified (e.g., Perkins & Willson 2005). Non-natives tend to have broad environmental tolerances, so wetlands dominated by them and thus having low species richness are more resistant to further change (Werner & Zedler 2002, Wigand et al. 2003). By itself, increased species richness in a wetland does not always confer increased resistance (decreased sensitivity) of a wetland's functions to artificial changes (e.g., Engelhardt & Kadlec 2001). In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.	HerbDom2
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Wetlands already dominated by non-native invasive species are likely to be more resistant to further impacts to their remaining plant communities from additional invasive plant species (Werner et al. 2002, Wigand et al. 2003, Stohlgren et al. 2002),	EmSens1_S
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3				
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Wetlands that are only saturated (no surface water) are more susceptible to year-to-year differences in precipitation, runoff, and flow. Some also are more vulnerable to invasion by non-native upland plants (Magee & Kentula 2005). In contrast, persistently-inundated wetlands tend to be deeper and have more "buffer" against annual variation in available water.	SatPct_S
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	1	2	2			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Decreases in water inputs will have the greatest impact on shallow wetlands, even causing parts of them to cease being wetlands, and causing major changes in species and biogeochemical processes in the remaining wetland. Also, among wetlands having the same area, shallow wetlands have less volume than deeper ones and thus experience less dilution of incoming contaminants. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.	Depth_S
		<10 cm deep (but >0).	0	4	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.20	Ponded waters are more susceptible to developing oxygen deficits and bioaccumulating contaminants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry_S
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Narrow wetlands tend to be more susceptible to erosion from waves and currents. Their microclimate also is more precarious, trees are more subject to windthrow (Martin & Grotenfendt 2007, Bahuguna et al. 2010), and their wildlife may be more susceptible to predation. In narrow strips or small patches of vegetation, the native plant communities are more vulnerable to invasion from non-native species from adjoining lands (Hennings & Edge 2003). A study in Alberta found that non-native plants within forests there were most abundant between 15 and 50 ft from the edge, and some of those species were found up to 130 ft from the edge. Although larger patches of forest generally supported more non-natives species than smaller fragments, the smallest fragments had the greatest number of non-native species per square meter (Gignac & Dale 2007). Wooded buffers with dense vegetation tend to restrict wind-driven dispersal of seeds of non-native plants into the area protected by a buffer (Cadenzas & Pickett 2001). If the adjoining uplands are not forested, a greater proportion of the trees in narrow wetlands are subject to blowdown, and the wetland's plants and animals are more subject to extremes of the surrounding microclimate as well as disturbance from humans in nearby uplands. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	VwidthAbs_S
		<1 m.	0	6	0			
		1 - 9 m.	0	4	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	2	2			
		50 - 100 m.	0	1	0			
		> 100 m, or open water is absent at that time.	0	0	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.00	If a wetland lacks surface water outflow, nearly all contaminants that enter it will remain and be accumulated over time (Oberts 1977). This is particularly true of runoff-borne sediment, which can eventually fill a wetland and thus destroy it (Whited 2001, Whigham & Jordan 2003, Leibowitz 2003).	OutDura_S
		Persistent (surface water flows out for >9 months/year).	1	0	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	1	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	4	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	5	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.00	Narrow outlets limit water outflow from a wetland and thus tend to cause the wetland to confine and accumulate sediment that has been washed in. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric_S
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	0	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	1	0			
F47	pH Measurement	The pH in most of the AA's surface water:					Low-pH wetlands are particularly sensitive to further acidification by acid rain. They are often darkly tea-coloured due to tannins associated with humic acids. *In calculations, the indicator score is set to 1 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	AcidicS
		Was measured, and is: [enter the reading in the column to the right.]	7.09					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				1.00	Wetlands with lower conductivity or TDS generally (but not always) have lower alkalinity, which otherwise would buffer the wetland's chemistry against large changes induced by acid rain. In calculations, the indicator score is set to 1 if TDS<300 mg/L or conductivity is <600 µS/cm or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.	ConductivS
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	19					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	36					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Wetlands whose existence or extent depends on beaver are more sensitive in the sense that they may not be sustained naturally over time if beaver populations and associated beaver dams decline.	Beaver_S
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if large and/or surrounded by other natural landscapes, and/or if they are near other wetlands of the same type, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegCUpct_
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	1	3	3			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.40	Wetlands adjoined by steep slopes are likely to be subject to more sediment and contaminant input, other factors being equal.	BuffSlope_S
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	5	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Man-made wetlands typically have less diverse vegetation and limited soil carbon, making them more sensitive to extreme natural events and slower to recover.	NewWet_S
		No.	0	0	0			
		Yes, and created or expanded 20 - 100 years ago.	0	1	0			
		Yes, and created or expanded 3-20 years ago.	0	2	0			
		Yes, and created or expanded within last 3 years.	0	3	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Abiotic Resistance/ Sensitivity	0.28	AVERAGE [OutDura X AVERAGE(SatPct, CUratio, IsoDry, Depth, Constric), AVERAGE(BuffSlope, SoilTex, Beaver)]	AbioSens
Biotic Resistance/ Sensitivity	0.63	AVERAGE [AVERAGE[VwidthAbs, WetSize, (AVERAGE(EmSens, ShrubPattS, WoodySens2, Gcover, UpEdge)), RareSpp]	BioSens
Resilience/ Recovery Duration - Site Fertility & Climate	0.80	AVERAGE[GDD, AVERAGE(Wettype, Nfix, NewWet, Acidic, Conductiv)]	Fertility
Resilience/ Recovery Duration - Colonizer Availability Influence	0.49	AVERAGE(HerbDom, Elev, NatVegProx, NatVegSize, NatVegCUpct, PondProx, LakeProx)	Colonizer
Resilience/ Recovery Duration - Veg Growth Rate Influence	0.00	AVERAGE(TreeDBHs, TreeCover)	GrowthRate

Score for Wetland Sensitivity	SEN	4.39	AVERAGE(AbioSens, BioSens, Fertility, Climate, Colonizer, GrowthRate)

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Wetland Stressors	The degree to which a wetland is, or has recently been altered by, or exposed to risk from, factors capable of reducing one or more of its functions and which are primarily human-related.	STR				

#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.40	PopCtrDist
		<100 m.	0	5	0		
		100 - 500 m.	0	3	0		
		0.5- 1 km.	1	2	2		
		1 - 5 km.	0	1	0		
		>5 km.	0	0	0		
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	DistRd
		<10 m.	0	5	0		
		10 - 25 m.	0	4	0		
		25 - 50 m.	0	2	0		
		50 - 100 m.	0	1	0		
		100 - 500 m.	0	1	0		
		>500 m.	1	0	0		
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			1.00	RdBox
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					ToxicData
		The condition is present within the AA.	0				
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0				
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing	0				
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1				
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	CAimperv
		<10%.	1	0	0		
		10 to 25%.	0	2	0		
		>25%.	0	3	0		
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				1.00	OwnerSS
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	0	0		
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0		
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	1	0		
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	2	2		
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				0.00	WeedSource
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	0	0		
		some (but <5%) of the upland edge.	0	1	0		
		5-50% of the upland edge.	0	2	0		
		most (>50%) of the upland edge.	0	3	0		
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.00	Constricted
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	1	0		
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	0	0		
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0		
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.50	NatVegCA
		<5%.	0	4	0		
		5 to 30%.	0	3	0		
		30 to 60%.	1	2	2		
		60 to 90%.	0	1	0		
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0		
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	BuffDisturbTyp
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0		
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1		
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.00	BurnHist
		Burned within past 5 years.	0	4	0		
		Burned 6-10 years ago.	0	3	0		
		Burned 11-30 years ago.	0	2	0		
		Burned >30 years ago, or no evidence of a burn and no data.	1	0	0		

#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				0.00	VisibWet
		<25%.	1	0	0		
		25-50%.	0	1	0		
		>50%.	0	2	0		
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.25	RecUse
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	0	1	0		
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1	1		
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1	0		
		The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]	0	1	0		
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Core1
		<5% and no inhabited building is within 100 m of the AA.	0	5	0		
		<5% and inhabited building is within 100 m of the AA.	0	5	0		
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0		
		5-50% and inhabited building is within 100 m of the AA.	0	2	0		
		50-95%, with or without inhabited building nearby.	0	1	0		
		>95% of the AA with or without inhabited building nearby.	1	0	0		
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.00	Core2
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	0	0		
		5-50%.	0	1	0		
		50-95%.	0	3	0		
		>95% of the AA.	0	3	0		
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.25	AltTiming
S2	Accelerated Inputs of Contaminants and/or	Stressor subscore=	1			0.56	Toxic
S3	Accelerated Inputs of Nutrients	Stressor subscore=	1			0.56	Enrich
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0			0.08	SedLoad
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	1			0.50	SoilDisturb

Hydrologic Stressors	0.13	AVERAGE(AltTiming, Constricted)	HydroStress
Water Quality Stressors	0.37	AVERAGE(Toxic, ToxicData, Enrich, SedLoad, SoilDisturb, CAimperv, BuffDisturbTyp)	WQstress
Fragmentation Stressors	0.50	AVERAGE(NatVegCA, RdBox, WeedSource)	FragStress
Disturbance Stressors	0.21	AVERAGE(RecUse, Core1, Core2, DistRd, VisibWet, PopCtrDist, Owner, BurnHist)	DisturbStress

Score for Stressors to Wetland	S	4.00	(MAX(HydroStress, WQstress, FragStress, DisturbStress)) + AVERAGE(HydroStress, WQstress, FragStress, DisturbStress))/2

Assessment Area (AA) Results:

Wetland ID: WL-4-WM

Date: July 29, 2022

Observer: Zacharye Simai

Latitude & Longitude (decimal degrees): 45.578428 -63.741889

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.43	Lower	4.79	Moderate	3.76	2.13
Stream Flow Support (SFS)	4.55	Moderate	10.00	Higher	3.67	6.75
Water Cooling (WC)	6.71	Higher	7.05	Higher	4.47	3.82
Sediment Retention & Stabilisation (SR)	4.75	Moderate	8.49	Higher	5.90	4.16
Phosphorus Retention (PR)	1.32	Lower	7.77	Higher	4.57	6.04
Nitrate Removal & Retention (NR)	3.89	Moderate	10.00	Higher	5.59	10.00
Carbon Sequestration (CS)	3.53	Moderate			6.87	
Organic Nutrient Export (OE)	9.37	Higher			6.12	
Anadromous Fish Habitat (FA)	7.15	Higher	3.18	Moderate	4.69	2.02
Resident Fish Habitat (FR)	8.36	Higher	2.91	Moderate	4.54	1.82
Aquatic Invertebrate Habitat (INV)	5.55	Higher	7.81	Higher	5.76	5.45
Amphibian & Turtle Habitat (AM)	6.08	Moderate	4.49	Moderate	6.31	5.46
Waterbird Feeding Habitat (WBF)	6.67	Higher	3.33	Moderate	5.08	3.33
Waterbird Nesting Habitat (WBN)	5.69	Moderate	3.33	Moderate	4.13	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.15	Higher	10.00	Higher	7.96	10.00
Pollinator Habitat (POL)	7.66	Moderate	3.33	Moderate	6.34	3.33
Native Plant Habitat (PH)	4.89	Moderate	5.88	Moderate	5.85	5.88
Public Use & Recognition (PU)			0.34	Lower		0.53
Wetland Sensitivity (Sens)			10.00	Higher		5.30
Wetland Ecological Condition (EC)			5.36	Moderate		7.78
Wetland Stressors (STR) (higher score means more stress)			7.43	Higher		3.75
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.43	Lower	4.79	Moderate	3.76	2.13
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.06	Moderate	9.38	Higher	6.30	8.37
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.96	Higher	9.14	Higher	5.56	6.04
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.57	Higher	3.97	Moderate	5.63	4.32
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.19	Higher	8.20	Moderate	7.34	8.20
WETLAND CONDITION (EC)			5.36	Moderate		7.78
WETLAND RISK (average of Sensitivity & Stressors)			8.71	Higher		4.52

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	11.66209946	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	38.06532793	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	72.75731321	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	30.04067002	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	67.15557856	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-5-WM

Date: July 14, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.5745 -63.7475

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.39	Lower	8.01	Higher	2.99	3.55
Stream Flow Support (SFS)	3.45	Moderate	8.29	Higher	2.78	5.51
Water Cooling (WC)	7.65	Higher	1.51	Lower	5.10	0.82
Sediment Retention & Stabilisation (SR)	2.25	Lower	8.91	Higher	3.95	4.37
Phosphorus Retention (PR)	1.73	Lower	8.84	Higher	4.83	6.88
Nitrate Removal & Retention (NR)	2.30	Lower	10.00	Higher	4.44	10.00
Carbon Sequestration (CS)	5.30	Moderate			7.70	
Organic Nutrient Export (OE)	9.59	Higher			6.27	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	4.89	Moderate	4.44	Moderate	5.49	3.64
Amphibian & Turtle Habitat (AM)	5.25	Moderate	3.71	Moderate	5.87	4.82
Waterbird Feeding Habitat (WBF)	5.39	Moderate	2.50	Lower	4.10	2.50
Waterbird Nesting Habitat (WBN)	5.50	Moderate	2.50	Moderate	3.99	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	9.03	Higher	2.50	Lower	7.86	2.50
Pollinator Habitat (POL)	7.96	Higher	0.00	Lower	6.59	0.00
Native Plant Habitat (PH)	3.45	Lower	4.82	Lower	5.28	4.82
Public Use & Recognition (PU)			1.95	Moderate		1.64
Wetland Sensitivity (Sens)			5.45	Moderate		3.72
Wetland Ecological Condition (EC)			4.78	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			8.33	Higher		4.18
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.39	Lower	8.01	Higher	2.99	3.55
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.10	Moderate	9.63	Higher	6.47	8.54
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	8.00	Higher	6.52	Moderate	5.59	4.42
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.36	Moderate	2.73	Moderate	4.33	3.39
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.92	Higher	3.63	Lower	7.22	3.63
WETLAND CONDITION (EC)			4.78	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			6.89	Higher		3.95

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	11.16376375	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	39.44286017	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	52.10489694	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	11.89623048	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	28.7341766	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Cover Page: Basic Description of Assessment	WESP-AC version 2
Site Name:	WL-6-WM
Investigator Name:	Chris Kennedy & Zacharye Simai
Date of Field Assessment:	July 15, 2022
Nearest Town:	Westchester Mountain, NS
Latitude (decimal degrees):	45.564376
Longitude (decimal degrees):	-63.720912
Is a map based on a formal on-site wetland delineation available?	Yes
Approximate size of the Assessment Area (AA, in hectares):	4.51
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	100
What percent (approx.) of the wetland were you able to visit?	100
What percent (approx.) of the AA were you able to visit?	100
Were you able to ask the site owner/manager about any of the questions?	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	Yes
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	Yes
How many wetlands have you assessed previously using WESP-AC? (approx.)	200+
Comments about the site or this WESP-AC assessment (attach extra page if desired):	

Date: October 17, 2022	Site Identifier: WL-6-WM	Investigator: Kelly Regan

Form OF (Office). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia wetlands only. DIRECTIONS: Conduct an assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answering many of the questions below will require using these online map viewers:

Google Earth Pro: https://www.google.com/earth/download/gep/agree.html
Provincial Landscape Viewer: https://nsgi.novascotia.ca/plv/

For most wetlands, completing this office data form will require 1-2 hours. For a list of functions to which each question pertains, see bracketed abbreviations in the Definitions/Explanations column. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF1	Province	Mark the province in which the AA is located by changing the 0 in the column next to it to a "1". Mark only one.		This determines to which province's calibration wetlands the raw score of any wetland is normalised. In the function and benefits models, it also triggers the automatic exclusion of indicators for which no spatial data exists in a particular province.
		New Brunswick	0	
		Nova Scotia	1	
		Prince Edward Island	0	
		Newfoundland-Labrador	0	
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		"Adjacent" means not separated from the AA by a wide expanse (>50 m) of upland (including roads >50 m wide). Include ponded areas likely to be hidden by wetland vegetation. If surface water extends beyond 1 km, include only the part within 1 km. Do not include tidal areas. Measure the area from aerial imagery using Google Earth Pro (click on Ruler icon in toolbar, then Polygon in pop-up menu). [PH, SBM, WBN]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	1	
		1 to 10 hectares.	0	
		10 to 100 hectares.	0	
		>100 hectares.	0	
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		See definition of adjacent in OF2. If the AA's wetland vegetation extends beyond 1 km, include only the part within 1 km. "Ponded" means not flowing in rivers or streams. [Sens, WBF]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	0	
		1 to 10 hectares.	1	
		10 to 100 hectares.	0	
		>100 hectares.	0	
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:		See definition of adjacent in OF2. Use Google Earth Pro's polygon ruler (as described above). Exclude conifer plantations only if it is obvious that trees were planted in rows. [AM, PH, SBM, Sens]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	0	
		1 to 10 hectares.	0	
		10 to 100 hectares.	0	
		100 to 1000 hectares.	1	
		>1000 hectares. [*This is nearly always the answer in relatively undeveloped landscapes.*]	0	
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest *vegetated land* (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:		To measure distance, use Google Earth Pro (Ruler > Line tool). The 375-ha criterion is from the Fundy Model Forest Project. [AM, PH, POL, SBM, Sens]
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	
		50-500 m, and not separated.	0	
		50-500 m, but separated by those features.	0	
		0.5 - 5 km, and not separated.	0	
		0.5 - 5 km, but separated by those features.	1	
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0	For this question only, consider moss to be herbaceous vegetation. Determine the score by viewing aerial imagery in Google Earth after successively drawing or estimating the boundaries of the buffers of 5 km, 1 km, and 100 m radius focused on the center of the AA. Circles of specified radius can be drawn in Google Earth Pro by clicking on the Ruler icon, then Circle in the pop-up menu. [AMv, PHv, POLv, SBMv, WBFv, WBNv]
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1	See above. Do not consider conifer plantations to be forest if it is obvious that trees were planted in rows. [AMv, PHv, POLv, SBMv]

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:		In Google Earth, draw the 5 km buffer and then estimate land cover percentages, or do GIS analysis of an appropriate land cover layer. [AM, PH, POL, SBM, Sens]
		<5% of the land.	0	
		5 to 20% of the land.	0	
		20 to 60% of the land.	1	
		60 to 90% of the land.	0	
		>90% of the land. SKIP to OF10.	0	
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:		[AM, SBM]
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:		"Population center" means a settled area with more than about 5 regularly- inhabited structures per square kilometer. In Google Earth Pro, click on the Ruler icon, then Path, and draw and measure the route. [FAv, FRv, NRv, PH, PU, SBM, WBFv]
		<100 m.	0	
		100 - 500 m.	0	
		0.5- 1 km.	0	
		1 - 5 km.	1	
		>5 km.	0	
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:		Determine this by viewing aerial imagery in Google Earth Pro and measuring with the Ruler>Line tool. [AM, FAv, FRv, NRv, PH, PU, SBM, STR, WBN]
		<10 m.	1	
		10 - 25 m.	0	
		25 - 50 m.	0	
		50 - 100 m.	0	
		100 - 500 m.	1	
		>500 m.	0	
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0	Draw the 5 km circle in Google Earth Pro using the Circle tool and search for roads and wetlands within it, being alert for roads hidden under forest canopy. [AM, SBM, STR]
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:		In Google Earth Pro, zoom in closely to examine the surrounding landscape for ponds, lakes, and wetlands that appear to be permanently flooded. [AM, PH, SBM, Sens, WBF, WBN]
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	
		<50 m, but completely separated by those features.	0	
		50-500 m, and not separated.	0	
		50-500 m, but separated by those features.	1	
		0.5 - 1 km, and not separated.	0	
		0.5 - 1 km, but separated by those features.	0	
		None of the above (the closest patches or corridors that large are >1 km away).	0	
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:		Determine this by viewing aerial imagery in Google Earth. [Sens, WBF, WBN]
		<100 m.	0	
		100 m - 1 km.	0	
		1 -2 km.	0	
		2-5 km.	1	
		5-10 km.	0	
		>10 km.	0	
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:		In Google Earth, measure the distance to the ocean (including Bay of Fundy) or tidal river, whichever is closer. If you need to see how far upriver a river is tidal, see the KMZ file provided with this calculator for NS (NS Headtide). Points shown in those files are only an approximation, so local information if available may be preferable. [FA, WBF]
		<100 m.	0	
		100 m - 1 km.	0	
		1 - 5 km.	0	
		5-10 km.	0	
		10-40 km.	1	
		>40 km.	0	
OF16	Upland Edge Contact	Select one:		[NR, SBM, Sens]
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):		Contact local authories to determine if such maps exist. Where available, LiDAR imagery can provide finer elevational resolution useful for flood modeling. [WSv]
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).	0.70	[FA, NR, Sens, SFSv, WCv, WSv]
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0	If an ACCDC report is available for this AA, it also may contain such information. [NRv]

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:		May use existing data, or sample those waters as part of this wetland assessment. "Harmful" should be evaluated with regard to current federal or provincial water quality standards. [AM, FA, FR, NRv, PRv, SRv, STR, WBF, WBN]
		The condition is present within the AA.	0	
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0	
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:		May use existing data, or monitor waters as part of this wetland assessment. [NRv, PRv, SRv]
		The condition is present within 1 km downslope and connected to the AA by a channel.	0	
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0	
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:		Topographic maps may be viewed online at the National Atlas of Canada (Toporama): http://atlas.gc.ca/toporama/en/index.html [NR, PR, Sens, SR, WS]
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	
		0.01 to 0.1.	0	
		0.1 to 1.	1	
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :		[FA, INV, NRv, PRv, SRv, STR, WCv, WSv]
		<10%.	0	
		10 to 25%.	1	
		>25%.	0	
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:		[NRv, PRv, SRv, WSv]
		Mostly true.	1	
		Somewhat true.	0	
		Mostly untrue.	0	
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:		[AM, NR, SFS, WC, WS]
		Northward (N, NE). north-facing contributing area.	0	
		Southward (S, SW). south-facing contributing area.	1	
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:		Identify inlets and outlets, if any, from topographic maps (use elevations to determine which are inlets and which are outlets) and augment by field inspection. With the Provincial Landscape Viewer, select Nova Scotia Topo as the Basemap. Also enable the layer Forestry>WAM Predicted Flow. Then measure the inlet-outlet distance. [NR, OE, PR, SR, WS]
		<10 m.	0	
		10 - 50 m.	0	
		50 - 100 m.	0	
		100 - 1000 m.	1	
		1- 2 km.	0	
		>2 km, or wetland lacks an inlet and outlet.	0	
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903	This layer was provided by Dr. Dan McKenney of the Canadian Forest Service [AM, CS, FR, INV, NR, OE, PH, PR, Sens, SR, WBF, WCv, WS]
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [*Mark just the first choice that is true.]* :		Regarding the last choice, if uncertain if an AA is fishless, consider the possibility its waters have been stocked. [AM, FA, FR, INV, WBF, WBN]
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites: http://www.salmonatlas.com/atlanticsalmon/canada-east/index.1.html http://atlanticsalmonfederation.org/rivers/introduction.html	1	
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented *[mark all applicable*]:		Request information from ACCDC and/or conduct your own survey at an appropriate season using an approved protocol. For birds, also check eBird.org. NOTE for NS: If your WESP-AC is being completed for a Wetland Alteration Application to NS-ECC, your ACCDC results and any taxon-specific survey results must be submitted along with your WESP-AC results, and application. [AMv, EC, PHv, POLv, SBMv, Sens, WBFv, WBNv]
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	1	
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	
		None of the above, or no data.	0	
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0	The source of this layer, which should be checked periodically for updates, is: http://www.ibacanada.com/mapviewer.jsp?lang=EN [SBMv, WBFv, WBNv]
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.		This was provided by Dr. David Leske. [WBNv]

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1	[SBM]
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0	See: https://novascotia.ca/parksandprotectedareas/plan/interactive-map/ [PU]
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0	[PU]
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.		[AM, FA, FR, INV, PH]
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.		"Private lands" may include those owned or leased by non-governmental organizations, e.g., charitable conservation land trusts, DUC, TNC. [PU, STR]
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	

Date: July 15, 2022	Site Identifier: WL-6-WM	Investigator: Chris Kennedy & Zacharye Simai

Form F (Field). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia. DIRECTIONS: Walk for no less than 10 minutes from the wetland edge towards its core, in the part of the AA that is proposed for alteration. If no alteration is proposed, walk in a portion that appears to be most representative of the wetland overall. Walk only where it is safe and legal to do so. Conduct the assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answer these questions primarily based on your onsite observations and interpretations. Do not write in shaded parts of this data form. Answering some questions accurately may require conferring with the landowner or other knowledgable persons, and/or reviewing aerial imagery. For most wetlands, completing this field data form will require 1-2 hours on a site. For a list of functions to which each question pertains, see the accompanying Interpretations form. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage & Delay, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:		Ericaceous shrubs are ones in the heather family (Ericaceae). Most have leathery evergreen leaves. They include rhododendron, azalea, swamp laurel, leatherleaf, Labrador tea, and others. Most require acidic soil. Although not in the family Ericaceae, sweetgale (*Myrica gale*) should be counted also. [AM, CS, FA, FR, INV, NR, OE, PH, Sens, SFS, WBF, WBN]
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.		
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (*Carex rariflor* a). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:		
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	
Reminder : For all questions, the AA should include all persistent waters in ponds smaller than 8 hectares (~283 m on a side) that are adjacent to the AA. The AA should also include part of the water area of adjacent ponded water larger than 8 ha and adjacent rivers wider than 20 m. Specifically, the AA should include the open water part adjacent to wetland vegetation and equal in width to the average width of that vegetated zone. Throughout this data form, " adjacent " is used synonymously with abutting, adjoining, bordering, contiguous -- and means no upland (manmade or natural) completely separates the described features along their directly shared edge. Features joined only by a channel are not necessarily considered to be adjacent -- a large portion of their edges must match. The features do not have to be hydrologically connected in order to be considered adjacent.				
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, INV, SBM, WBF]
		A1.	0	
		A2.	1	
		B1.	0	
		B2.	0	
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.		Deciduous shrubs in this region usually include buttonbush, Labrador tea, bayberry (*Morella*), huckleberry, cranberry, cloudberry, sweetgale, alder, willow, birch, ash, dogwood, and a few others. If you assigned a code of 3 or higher to any of the first four choices and the ground cover beneath the trees/shrubs is <25% moss, then question F1 might be "B1". [CS, INV, NR, PH, POL, SBM, Sens]
		coniferous trees (may include tamarack) taller than 3 m.	0	
		deciduous trees taller than 3 m.	0	
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	0	
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	5	
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1	
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1	
Note : If none of top 4 rows in F3 was marked 2 or greater , SKIP to F9 (N fixers).				
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:		[PH, POL, SBM, Sens]
		those species together comprise > 50% of such cover.	1	
		those species together do not comprise > 50% of such cover.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.		Estimate the diameters at chest height. If small-diameter trees are overtopped (shaded) by larger ones, visualise a "subcanopy" at the average height of the smaller-dbh trees, to serve as a basis for the minimum 5% canopy requirement in this question. The trees and shrubs need not be wetland species. [AM, CS, POL, SBM, Sens, WBN]
		coniferous, 1-9 cm diameter and >1 m tall.	0	
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	
		coniferous, 10-19 cm diameter.	0	
		broad-leaved deciduous 10-19 cm diameter.	0	
		coniferous, 20-40 cm diameter.	0	
		broad-leaved deciduous 20-40 cm diameter.	0	
		coniferous, >40 cm diameter.	0	
		broad-leaved deciduous >40 cm diameter.	0	
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:		[AM, INV, NR, PH, SBM, Sens]
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They <u>each</u> comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.		
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:		
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:		Snags are dead standing trees that often (not always) lack bark and foliage. Include only ones that are at least 2 m tall. [POL, SBM, WBN]
		None, or fewer than 8/ hectare which exceed this diameter.	1	
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	
		Several (>8/hectare) but above not true.	0	
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:		Exclude temporary "burn piles." [AM, INV, POL, SBM]
		Few or none that meet these criteria.	1	
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:		Do not include N-fixing algae or lichens. [FA, FR, INV, NRv, OE, PH, SBM, Sens]
		<1% or none.	0	
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:		Exclude moss growing on trees and rocks. [CS, PH]
		<5% of the vegetated part of the AA.	0	
		5-25% of the vegetated part of the AA.	1	
		25-50% of the vegetated part of the AA.	0	
		50-95% of the vegetated part of the AA.	0	
		>95% of the vegetated part of the AA.	0	
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:		Thatch is dead plant material (stems, leaves) resting on the ground surface. Bare ground that is present under a tree or shrub canopy should be counted. Boulders count as bare ground. Wetlands with mineral soils and that are heavily shaded or are dominated by annual plant species tend to have more extensive areas that are bare during the early growing season. [AM, EC, INV, NR, OE, POL, PR, SBM, Sens]
		Little or no (<5%) *bare ground* is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	
		Other conditions.	0	
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0	
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:		The depressions may be of human or natural origin. [AM, EC, INV, NR, PH, POL, PR, SBM, SR, WS]
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	
		Intermediate.	0	
		Several (extensive micro-topography).	1	
F13	Upland Inclusions	Within the AA, inclusions of upland are:		[AM, NR, SBM]
		Few or none.	1	
		Intermediate (1 - 10% of vegetated part of the AA).	0	
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [*To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]*		[CS, NR, OE, PH, PR, Sens, SFS, WS]
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	
		Deep Peat, to 40 cm depth or greater.	0	
		Shallow Peat or organic <40 cm deep.	0	
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]		This addresses needs of many but not all migratory sandpipers, plovers, and related species. [WBF]
		None, or <100 sq. m.	1	
		100-1000 sq. m.	0	
		1000 – 10,000 sq. m.	0	
		>10,000 sq. m.	0	
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:		[AM, WBF, WBN]
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	1	
		5-25% of the vegetated part of the AA.	0	
		25-50% of the vegetated part of the AA.	0	
		50-95% of the vegetated part of the AA.	0	
		>95% of the vegetated part of the AA.	0	
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:		Forbs are flowering plants. Do not include grasses, sedges, cattail, other graminoids, ferns, horsetails, or others that lack showy flowers. [POL]
		<5% of the herbaceous part of the AA.	0	
		5-25% of the herbaceous part of the AA.	0	
		25-50% of the herbaceous part of the AA.	0	
		50-95% of the herbaceous part of the AA.	0	
		>95% of the herbaceous part of the AA.	0	
F18	Sedge Cover	Sedges (*Carex* spp.) and cottongrass (*Eriophorum* spp.) occupy:		[CS]
		<5% of the vegetated area, or none.	0	
		5-50% of the vegetated area.	0	
		50-95% of the vegetated area.	0	
		>95% of the vegetated area.	0	
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:		For this question, include ferns as well as graminoids and forbs. [EC, INV, PH, POL, Sens]
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.		[EC, PH, POL, Sens]
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	0	
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	1	
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:		If a plant cannot be identified to species (e.g., winter conditions) but its genus contains an exotic species, assume the unidentified plant to also be exotic. If vegetation is so senesced that exotic species cannot be identified, answer "none". [PH, STR]
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	0	
		some (but <5%) of the upland edge.	1	
		5-50% of the upland edge.	0	
		most (>50%) of the upland edge.	0	
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0	[WBF, WBN, WCv]
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0	[FR, PR, PU, WBF, WBN]
F24	% of AA Without Surface Water	The percentage of the AA that <u>never</u> contains <u>surface</u> water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, FA, FR, INV, NR, PH, PR, SBM, Sens, SRv, WBF, WBN, WC]
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	
		25-50% of the AA never contains surface water.	0	
		50-75% of the AA never contains surface water.	1	
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:		If you are unable to determine the condition at the driest time of year, ask the land owner or neighbors about it if possible. Indicators of persistence may include fish, some dragonflies, beaver, and muskrat. [AM, CS, FA, FR, INV, NR, POL, PR, SBM, WBF, WBN]
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	
		1-20% of the AA.	1	
		20-50% of the AA.	0	
		50-95% of the AA.	0	
		>95% of the AA. True for many fringe wetlands.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:		[FA, WC]
		<5% of the water is shaded, or no surface water is present then.	0	
		5-25% of the water is shaded.	0	
		25-50% of the water is shaded.	1	
		50-75% of the water is shaded.	0	
		>75% of the water is shaded.	0	
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:		Flood marks (algal mats, adventitious roots, debris lines, ice scour, etc.) are often evident when not fully inundated. Also, such areas often have a larger proportion of upland and annual (vs. perennial) plant species. In riverine systems, the extent of this zone can be estimated by multiplying by 2 the bankful height and visualising where that would intercept the land along the river. [CS, FA, INV, NR, OE, PH, SR, WBF, WBN, WS]
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	
		1-20% of the AA, or <1% but >0.01 ha.	0	
		20-50% of the AA.	0	
		50-95% of the AA.	1	
		>95% of the AA.	0	
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:		Look for flood marks (see above). Because the annual range of water levels is difficult to estimate without multiple visits, consider asking the land owner or neighbors about it. [AM, CS, INV, NR, OE, PH, PR, SR, WBN, WS]
		<10 cm change (stable or nearly so).	0	
		10 cm - 50 cm change.	1	
		0.5 - 1 m change.	0	
		1-2 m change.	0	
		>2 m change.	0	
Is the AA plus adjacent ponded water smaller than 0.01 hectare (about 10m x 10m, or 1m x 100 m)? If so, enter "1" in column D and SKIP TO F42 (Connection).			0	
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:		If a boat is unavailable, estimate this by considering wetland size and local topography. Or if timing and safety allow, depths may be measured by drilling through winter ice.This question is asking about the spatial median depth that occurs during most of that time, even if inundation is only seasonal or temporary. If inundation in most but not all of the wetland is brief, the answer will be based on the depth of the most persistently inundated part of the wetland. Include surface water in channels and ditches as well as ponded areas. [CS, FA, FR, INV, OE, PH, PR, Sens, SFS, SR, WBF, WBN, WC]
		<10 cm deep (but >0).	0	
		10 - 50 cm deep.	1	
		0.5 - 1 m deep.	0	
		1 - 2 m deep.	0	
		>2 m deep. True for many fringe wetlands.	0	
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):		Estimate these proportions by considering the gradient and microtopography of the site. [FR, INV, WBF, WBN]
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question above).	0	
		One depth class that comprises 50-90% of the AA's inundated area.	1	
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:		Nearly all wetlands with surface water have some ponded water. [AM, CS, INV, NR, OE, PR, Sens, SR, WBF, WBN, WC, WS]
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	
		5-30% of the water.	0	
		30-70% of the water.	0	
		70-95% of the water.	0	
		>95% of the water.	0	
F32	Ponded Open Water - Minimum Size	During most of the growing season, the largest patch of open water that is ponded and is in or bordering the AA is >0.01 hectare (about 10 m by 10 m) and mostly deeper than 0.5 m. If true enter "1" and continue, If false, enter "0" and SKIP to F41 (Floating Algae & Duckweed).	0	Open water is not obscured by vegetation in aerial ("duck's eye") view. It includes vegetation floating on the water surface or entirely submersed beneath it.
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:		[AM, CS, FA, FR, INV, NR, OE, PR, SR, WBF, WBN, WC]
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	
		5-30% of the ponded water.	0	
		30-70% of the ponded water.	0	
		70-99% of the ponded water.	0	
		100% of the ponded water.	0	
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:		"Vegetated area" does not include underwater or floating-leaved plants, i.e., aquatic bed. Width may include wooded riparian areas if they have wetland soil or plant indicators. [AM, CS, NR, OE, PH, PR, SBM, Sens, SR, WBN]
		<1 m.	0	
		1 - 9 m.	0	
		10 - 29 m.	1	
		30 - 49 m.	0	
		50 - 100 m.	0	
		> 100 m, or open water is absent at that time.	0	
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water) is:		If several isolated pools are present in early summer, estimate the percent of their collective shorelines that has such a gentle slope. [SR, WBN]
		<1% of the water edge.	0	
		1-25% of the water edge.	0	
		25-50% of the water edge.	0	
		50-75% of the water edge.	0	
		>75% of the water edge.	1	
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (*Typha* spp.), common reed (*Phragmites*), or tall (>1m) bulrush is:		Emergent vegetation is herbaceous plants whose stems are partly above and partly below the water surface during most of the time water is present. [WBN]
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1	
		1-25% of the emergent vegetation.	0	
		25-75% of the emergent vegetation.	0	
		>75%, of the emergent vegetation.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:		[AM, FA, FR, INV, NR, OE, PH, PR, SBM, SR, WBF, WBN]
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	
		Intermediate.	0	
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	
F38	Persistent Deepwater Area	If the deepest patch of surface water (flowing or ponded) in or directly adjacent to the AA is mostly deeper than 0.5 m for >2 weeks during the growing season, enter "1" and continue. If not, enter "0" and SKIP to F42.(Connection).	0	
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:		For this question, consider only the wood that is at or above the water surface. Estimates of underwater wood based only on observations from terrestrial viewpoints are unreliable so should not be attempted. [AM, FA, FR, INV]
		Little or none.	0	
		Intermediate.	0	
		Extensive.	0	
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0	[WBN]
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0	[EC, PR, WBF]
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]		Consider the connection regardless of whether the surface water is frozen. The "downslope stream network" could consist of ditches, rivers, ponds, or lakes which eventually connect to the ocean. If this cannot be determined while visiting the AA, consult topographic maps perhaps by viewing these online with Toporama (http://atlas.nrcan.gc.ca/toporama/en/index.html) [CS, FA, FR, NR, OE, PR, Sens, SFS, SR, WCv, WS]
		Persistent (surface water flows out for >9 months/year).	1	
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:		"Major runoff events" would include biennial high water caused by storms and/or rapid snowmelt. [CS, NR, OE, PR, Sens, SR, STR, WS]
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1	If inlet tributaries cannot be searched for due to inaccessibility of part of the AA, follow suggestions in F42 above. [NRv, PH, PRv, SRv]
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	1	[WCv]
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].		[FA, FR, INV, NR, OE, PR, SR, WS]
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	
F47	pH Measurement	The pH in most of the AA's surface water:		Preferably, measure this in larger areas of ponded surface water within the AA, or in streams that have passed through (not along) most of the AA. Unless surface water is completely absent, do not dig holes or make depressions in peat in order to provide water for this measurement. Avoid measuring near roads or in puddles formed only by recent rain. [AM, FA, FR, NR, WBF, PH, PR, Sens, WBF, WBN]
		Was measured, and is: [*enter the reading in the column to the right.*]	6.3	
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0	
		Neither of above. Enter "1".	0	
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):		See above for measurement guidance. [FR, INV, NRv, PH, PRv, Sens]
		TDS is: [*Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.*]	26	
		Conductivity is [*Enter the reading in µS/cm in the column to the right.*]	54	
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0	
		Neither of above	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):		[FA, FR, PH, SBM, Sens, WBF, WBN]
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	
F50	Groundwater Strength of Evidence	Select first applicable choice:		Adhere to these criteria strictly -- do not use personal judgment based on fen conditions, pH, or other evidence. Consult topographic maps to detect breaks in slope described here. Rust deposits associated with groundwater seeps may be most noticeable as orange discoloration in ice formations along streams during early winter. [AM, CS, FA, FR, INV, NR, OE, PH, PRv, SFS, WC, WS]
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	
F51	Internal Gradient	The gradient along most of the flow path within the AA is:		This is not the same as the shoreline slope. It is the elevational difference between the AA's inlet and outlet, divided by the flow-distance between them and converted to percent. If available, use a clinometer to measure this. Free clinometer apps can be downloaded to smartphones. If the wetland is large (longer than ~1 km), this may be estimated using Google Earth to determine the minimum and maximum elevation within the AA, then dividing by length and multiplying by 100. [CS, NR, OE, PR, SR, WBF, WBN, WS]
		<2% or the AA has no surface water outlet (not even seasonally).	0	
		2-5%.	1	
		6-10%.	0	
		>10%.	0	
Note for the next three questions: If the AA lacks an upland edge, evaluate based on the AA's entire perimeter, and moving outward into whatever areas are adjacent. In many situations, these questions are best answered by measuring from aerial images.				
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:		[AM, FA, FR, INV, NRv, PH, POL, PRv, SBM, Sens, SRv, STR, WBN]
		<5%.	0	
		5 to 30%.	1	
		30 to 60%.	0	
		60 to 90%.	0	
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):		[AM, FA, INV, NRv, PH, POL, SBM, STR, WBN]
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:		[NRv, PRv, Sens, SRv]
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	
		2-5%.	0	
		5-30%.	1	
		>30%.	0	
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	Do not include upturned trees as potential den sites. [POL, SBM]
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):		Determine this using historical aerial photography, old maps, soil maps, or permit files as available [CS, NR, OE, PH, Sens]
		No.	0	
		Yes, and created or expanded 20 - 100 years ago.	0	
		Yes, and created or expanded 3-20 years ago.	0	
		Yes, and created or expanded within last 3 years.	0	
		Yes, but time of origin or expansion unknown.	0	
		Unknown if new or expanded within 20 years or not.	1	
F57	Burn History	More than 1% of the AA's previously vegetated area:		Look for charred soil or stumps (in multiple widely-spaced locations) or ask landowner. [CS, PH, STR]
		Burned within past 5 years.	0	
		Burned 6-10 years ago.	0	
		Burned 11-30 years ago.	0	
		Burned >30 years ago, or no evidence of a burn and no data.	1	
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:		[PU, STR, WBFv]
		<25%.	0	
		25-50%.	0	
		>50%.	1	
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:		[PU, STR]
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: *[Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]*		[AM, FAv, FRv, PH, PU, SBM, STR, WBF, WBN]
		<5% and no inhabited building is within 100 m of the AA.	0	
		<5% and inhabited building is within 100 m of the AA.	0	
		5-50% and no inhabited building is within 100 m of the AA.	0	
		5-50% and inhabited building is within 100 m of the AA.	1	
		50-95%, with or without inhabited building nearby.	0	
		>95% of the AA with or without inhabited building nearby.	0	
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: *[See note above.]*		[AM, PH, PU, SBM, STR, WBF, WBN]
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	
		5-50%.	1	
		50-95%.	0	
		>95% of the AA.	0	
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0	[PH, PU]
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	[AM, PU, WBF, WBN]
F64	Consumptive Uses (Provisioning Services)	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select ALL that apply.		[FAv, FRv, WBFv]
		Low-impact commercial timber harvest (e.g., selective thinning).	0	
		Commercial or traditional-use harvesting of native plants, their fruits, or mushrooms.	0	
		Waterfowl hunting.	0	
		Fishing.	0	
		Trapping of furbearers.	0	
		None of the above.	1	
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:		[NRv]
		Within 0-100 m. of the AA.	0	
		100-500 m. away.	0	
		>500 m. away, or no information.	1	
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0	[PH, PR]

Investigator: Chris Kennedy & Zacharye Simai	Site Identifier: WL-6-WM		Date: July 15, 2022	

Stressor (S) Data Form for Non-Tidal Wetlands. WESP-AC for Nova Scotia version 2.

					Data
S1	Aberrant Timing of Water Inputs				
	In the last column, place a check mark next to any item that is likely to have caused the timing of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either more muted (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) or more flashy (larger or more frequent spikes but over shorter times). [FA, FR, INV, PH, STR]				
	Stormwater from impervious surfaces that drains directly to the wetland.				
	Water subsidies from wastewater effluent, septic system leakage, snow storage areas, or irrigation.				
	Regular removal of surface or groundwater for irrigation or other consumptive use.				
	Flow regulation in tributaries or water level regulation in adjoining water body, or other control structure at water entry points that regulates inflow to the wetland.				
	A dam, dike, levee, weir, berm, or fill -- within or downgradient from the wetland -- that interferes with surface or subsurface flow in/out of the AA (e.g., road fill, wellpads, pipelines).				1
	Excavation within the wetland, e.g., dugout, artificial pond, dead-end ditch.				
	Artificial drains or ditches in or near the wetland.				1
	Accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level).				1
	Logging within the wetland.				1
	Subsidence or compaction of the wetland's substrate as a result of machinery, livestock, fire, drainage, or off road vehicles.				
	Straightening, ditching, dredging, and/or lining of tributary channels.				1
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Spatial extent of timing shift within the wetland:	>95% of wetland.	5-95% of wetland.	<5% of wetland.	2
	When most of the timing shift began:	<3 yrs ago.	3-9 yrs ago.	10-100 yrs ago.	1
	Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.				
	Input timing now vs. previously:	Shift of weeks.	Shift of days.	Shift of hours or minutes.	0
	Flashiness or muting:	Became very flashy or controlled.	Intermediate.	Became mildly flashy or controlled.	0
				Sum=	3
				Stressor subscore=	0.25
S2	Accelerated Inputs of Contaminants and/or Salts				
	In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of contaminants or salts to the AA. [AM, FA, PH, POL, STR]				
	Stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities.				
	Metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (download many locations from National Pollutant Release Inventory and view KMZ overlay in Google Earth. https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=B85A1846-1				
	Road salt.				
	Spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA.				1
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Usual toxicity of most toxic contaminants:	Industrial effluent, mining waste, unmanaged landfill.	Cropland, managed landfill, pipeline or transmission rights-of-way.	Low density residential.	2
	Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
	AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	1
				Sum=	4
				Stressor subscore=	0.44

Investigator: Chris Kennedy & Zacharye Simai	Site Identifier: WL-6-WM		Date: July 15, 2022	
Stressor (S) Data Form for Non-Tidal Wetlands. WESP-AC for Nova Scotia version 2.				Data
S3 Accelerated Inputs of Nutrients				
In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of nutrients to the wetland. [NRv, PRv, STR]				
Stormwater or wastewater effluent (including failing septic systems), landfills.				
Fertilizers applied to lawns, ag lands, or other areas in the CA.				1
Livestock, dogs.				
Artificial drainage of upslope lands.				
If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Type of loading:	High density of unmaintained septic, some types of industrial sources.	Moderate density septic, cropland, secondary wastewater treatment plant.	Livestock, pets, low density residential.	2
Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	1
			Sum=	4
			Stressor subscore=	0.44
S4 Excessive Sediment Loading *from Contributing Area*				
In the last column, place a check mark next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA. [FA, FR, INV, PH, SRv, STR]				
Erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires.				1
Erosion from construction, in-channel machinery in the CA.				
Erosion from off-road vehicles in the CA.				1
Erosion from livestock or foot traffic in the CA.				
Stormwater or wastewater effluent.				
Sediment from road sanding, gravel mining, other mining, oil/ gas extraction.				
Accelerated channel downcutting or headcutting of tributaries due to altered land use.				
Other human-related disturbances within the CA.				
If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Erosion in CA:	Extensive evidence, high intensity.*	Potentially (based on high-intensity* land use) or scattered evidence.	Potentially (based on low-intensity* land use) with little or no direct evidence.	2
Recentness of significant soil disturbance in the CA:	Current & ongoing.	1-12 months ago.	>1 yr ago.	1
Duration of sediment inputs to the wetland:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
AA proximity to actual or potential sources:	0 - 15 m.	15-100 m.	In more distant part of contributing area.	3
* high-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; low-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment.			Sum=	7
			Stressor subscore=	0.58
S5 Soil or Sediment Alteration *Within the Assessment Area*				
In the last column, place a check mark next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil. Consider only items occurring within past 100 years or since wetland was created or restored (whichever is less). [CS, INV, NR, PH, SR, STR]				
Compaction from machinery, off-road vehicles, livestock, or mountain bikes, especially during wetter periods.				
Leveling or other grading not to the natural contour.				
Tillage, plowing (but excluding disking for enhancement of native plants).				
Fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland.				1
Excavation.				
Ditch cleaning or dredging in or adjacent to the wetland.				
Boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments.				
Artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments.				
If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
	Severe (3 points)	Medium (2 points)	Mild (1 point)	
Spatial extent of altered soil:	>95% of wetland or >95% of its upland edge (if any).	5-95% of wetland or 5-95% of its upland edge (if any).	<5% of wetland and <5% of its upland edge (if any).	1
Recentness of significant soil alteration in wetland:	Current & ongoing.	1-12 months ago.	>1 yr ago.	1
Duration:	Long-lasting, minimal veg recovery.	Long-lasting but mostly revegetated.	Short-term, revegetated, not intense.	1
Timing of soil alteration:	Frequent and year-round.	Frequent but mostly seasonal.	Mainly during one-time or scattered events.	1
			Sum=	4
			Stressor subscore=	0.33

Assessment Area (AA) Results:

Wetland ID: WL-6-WM

Date: July 15, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.564376 -63.720912

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.91	Lower	10.00	Higher	3.37	6.13
Stream Flow Support (SFS)	2.69	Moderate	8.65	Higher	2.17	5.75
Water Cooling (WC)	6.80	Higher	10.00	Higher	4.53	5.72
Sediment Retention & Stabilisation (SR)	4.32	Moderate	10.00	Higher	5.57	5.35
Phosphorus Retention (PR)	0.59	Lower	9.91	Higher	4.12	7.71
Nitrate Removal & Retention (NR)	3.66	Moderate	10.00	Higher	5.42	10.00
Carbon Sequestration (CS)	0.74	Lower			5.55	
Organic Nutrient Export (OE)	8.18	Higher			5.34	
Anadromous Fish Habitat (FA)	6.79	Higher	7.01	Higher	4.45	4.45
Resident Fish Habitat (FR)	5.72	Higher	6.96	Higher	3.11	4.35
Aquatic Invertebrate Habitat (INV)	6.06	Higher	5.94	Moderate	5.96	4.44
Amphibian & Turtle Habitat (AM)	4.27	Moderate	3.44	Moderate	5.36	4.60
Waterbird Feeding Habitat (WBF)	4.03	Moderate	4.17	Moderate	3.07	4.17
Waterbird Nesting Habitat (WBN)	4.52	Moderate	2.50	Moderate	3.28	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	8.49	Higher	10.00	Higher	7.39	10.00
Pollinator Habitat (POL)	7.35	Moderate	10.00	Higher	6.09	10.00
Native Plant Habitat (PH)	2.94	Lower	10.00	Higher	5.07	10.00
Public Use & Recognition (PU)			3.22	Moderate		2.51
Wetland Sensitivity (Sens)			7.07	Moderate		4.19
Wetland Ecological Condition (EC)			3.91	Moderate		7.08
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher		5.81
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.91	Lower	10.00	Higher	3.37	6.13
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.33	Moderate	9.99	Higher	5.37	8.84
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.05	Higher	9.10	Higher	5.23	5.53
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.93	Moderate	5.91	Higher	4.61	4.30
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.38	Higher	10.00	Higher	6.79	10.00
WETLAND CONDITION (EC)			3.91	Moderate		7.08
WETLAND RISK (average of Sensitivity & Stressors)			8.54	Higher		5.00

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	19.12616398	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	33.22251106	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	64.18035424	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	35.06157688	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	73.76115073	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Water Storage & Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	WS					
#	**Function Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	If a wetland is capable of storing runoff, its positive effect on controlling downslope flood peaks is greater if it is large relative to the volume of runoff it receives, which is reflected somewhat by the extent of its contributing area. Wetlands that comprise a large portion of their contributing area have a greater potential to control the runoff arriving from that lmited area.	CApct1
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				1.00	North-facing slopes are likely to remain frozen for longer periods, thus limiting the soil's capacity to store or infiltrate runoff.	Aspect1
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	1	3	3			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	2	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	The longer the hydrologic path length, the greater the friction provided and thus the most effective a wetland potentially is at slowing or desynchonizing the downslope movement of runoff.	FloDist1
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer parts of the region imply a longer period of time during which the ground remains unfrozen and during which vegetation can potentially remove water via evapotranspiration.	_GDD1
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Large variation in elevations within a wetland, both at a micro- (~1 m) and macro (>10m) scale, suggest greater potential for trapping and retaining snow and other precipitation sufficiently long to allow runoff to infiltrate or evaporate from the wetland and thus delay or avoid its entry into downslope rivers (Kadlec et al. 1981, Price et al. 1990).	Girreg1
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	1	0			
		Intermediate.	0	2	0			
		Several (extensive micro-topography).	1	3	3			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	Considerable amounts of water can be stored below the land surface in peat and coarse-textured substrates. However, very little new runoff can be stored if the substrates are already saturated. Peat tends to be saturated much of the time, and groundwater discharge dominates many wetlands with coarse-textured substrate, keeping those saturated much of the time and thus limiting the capacity to store additional water. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water. Runoff ratio is greatest in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Quinton et al. 2003, Emili & Price 2006).	SoilTex
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	This directly estimates the relative amount of horizontal space in which precipitation and runoff are being stored, at least temporarily. The ability of wetland water storage to reduce stream peak flows is greatest in summer and fall, where those are the driest times of year (Roulet & Woo 1988, Quinton & Roulet 1998). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	3	3			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	This directly estimates the relative amount of vertical space in which precipitation and runoff are being stored, at least temporarily. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fluctua
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding indicates water is in storage rather than being transferred immediately downslope. Water distributed in small pools is more subject to loss via evapotranspiration before it can exit a wetland, and this delay can measurably reduce peak outflows (Price & Maloney 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that store water only temporarily or seasonally have longer periods during the year in which soils are unsaturated and thus able to briefly store or delay additional water from precipitation and runoff. Wetland connectivity is key to estimating wetland water storage: wetlands that lack an outlet (never have any outflow) store or dissipate (via evaporation or seepage) nearly all the water they receive (Spence et al. 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus increasing storage (Carter et al. 1979). The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	3	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	2	2			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.38	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the outflow and downstream movement of water (Price & Woo 1988). This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods), and is tall and stiff enough to provide some resistance (Arcement & Schneider 1989). However, woody vegetation itself occupies space otherwise available for storing water (this effect is usually negligible). Water also takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. Also is excluded automatically if no surface inflow.*	ThruFlo
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	3	3			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	4	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	6	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands fed constantly by groundwater are likely to have only limited subsurface storage space for storing additional precipitation. However, they may remain unfrozen for longer periods. *In calculations, is excluded automatically (cell goes blank) if no strong evidence of groundwater (last choice).*	Groundw
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	1	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	3	3			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.60	Sloping wetlands retain surface runoff and precipitation for shorter times.	Gradient
		<2% or the AA has no surface water outlet (not even seasonally).	0	5	0			
		2-5%.	1	3	3			
		6-10%.	0	2	0			
		>10%.	0	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):				0.00	Storage by wetlands is obviously more valuable when properties located downslope might otherwise be flooded. The need for (and value of) storage potentially provided by wetlands is greater when floodable property downslope is not being adequately protected by other water storage or detention features.	FloodBdg
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	4	0			
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	1	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	2	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	0	0			
OF23	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.70	Wetlands that store floodwater are more valuable if they are in the headwaters of a watershed, placing them above areas which might otherwise be damaged by floods.	ShedPos1
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.75	The need for (and value of) storage potentially provided by wetlands is greater when upland runoff is rapid, as occurs when much of the contributing area contains impervious surface (Laenen 1980, Waite et al. 2006). In contributing areas with extensive impervious surface, the proportion of stream flow due to surface runoff can be as much as five times that seen in forested catchments (Arnold & Gibbons 1996). The increase in surface runoff due to urbanization is especially greater in the Pacific Northwest due the naturally high infiltration capacity of the soils and the low intensity of the rainfall, which makes surface runoff a rare phenomenon in undeveloped watersheds (Booth & Jackson 1997). Increased surface runoff causes a shortening of the lag time between precipitation and stream flow response (Hirsch et al. 1990). The	CAunveg
		<10%.	0	0	0			
		10 to 25%.	1	3	3			
		>25%.	0	4	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients.				1.00		Transport
		Mostly true.	1	2	2			
		Somewhat true.	0	1	0			
		Mostly untrue.	0	0	0			

Subsurface Storage (Infiltration Capacity & ET)	0.47	[3*AVERAGE(SoilTex, Groundw, CApct) + AVERAGE(GDD, Aspect)] /4	Subsurf
Live Store	0.58	IF((AllSat1=1), blank, AVERAGE(Fluctua, SeasPct))	LiveStore
Friction	0.40	IF((AllSat1=1), (3*Gradient +AVERAGE(Gcover, Girreg))/4, ELSE: AVERAGE(Gradient, Constric, ThruFlo, FloDist, IsoDry)	Friction

Function Score for Water Storage	F	3.37	IF((AllSat1=1), AVERAGE [(OutDura, AVERAGE(Subsurface, Friction)], ELSE: AVERAGE [OutDura, (4*LiveStore + 2*Friction + Subsurf)/7))]
Benefits Score for Water Storage	B	6.13	IF((FloodBdg=1), 1, AVERAGE(FloodBdg, AVERAGE: (ShedPos, CAunveg, Transport))

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Stream Flow Support		The effectiveness for extending flow duration into drier parts of a growing season.	SFS					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.00	Snow tends to accumulate more on north-facing slopes due to less sun exposure, and water losses from evapotranspiration are less. Consequently, streamflow fed by such slopes may persist longer into drier periods.	Aspect2_
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	1	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	1	0			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Many or most fens are groundwater discharge areas (Siegel & Glaser 1987), and such discharge is more seasonally stable and thus more likely to contribute water late in the season when streamflow otherwise can be low. Some bogs, especially those that have outlets, discharge groundwater and thus potentially influence low flows (Siegal 1988). Where located near the Maritime coast, they lose relatively little water to evaporation and infiltration (Price 1992). Much of their water is released later in the spring and summer than in other wetland types, due to its remaining frozen later on account of the insulating effects of peat (Price & Maloney 1994). Water tables in riparian swamps and marshes typically fluctuate with river levels, and so are less likely to contribute much water during low flow conditions.	Wettype2
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	3	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	4	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	Peat soils retain water for longer periods than coarse mineral soils, and the deeper the better. Subsurface ice which helps sustain streamflow also may remain longer into the late spring in peatlands due to the insulating effects of peat. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water (Wiley & Curran 2003). Runoff ratio is greatest (surface water retention is least) in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Emili & Price 2006)	Soil2_
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Deeper water implies greater water volume to potentially feed downslope streams. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth2_
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	3	0			
		>2 m deep. True for many fringe wetlands.	0	4	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	This is the primary indicator of a wetland's potential for supporting summer flow in connected downslope streams.	OutDur2_
		Persistent (surface water flows out for >9 months/year).	1	6	6			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	3	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Wetlands fed by groundwater tend to remain saturated for longer in the summer, thus increasing their chances of supporting streamflow downslope (Burrell & Anderson 1991, Morley et al. 2011). Wetlands are typically ground water discharge areas where they occur at the toe of much steeper slopes (Crabtree & Burt 1983) or at geologic faults (Stein et al. 2004).	Groundw2_
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.70	Wetlands that contribute to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow that is affected by wetlands there is likely to be greater than in lowlands.	ShedPos2
	Function Scores	Function Score for Invertebrates				0.60	Summer streamflow is critical to supporting this group's productivity and diversity.	InvScore2
		Function Score for Anadromous Fish Habitat				0.45	Summer streamflow is critical to supporting this group's productivity and diversity.	AnadScore2
		Function Score for Non-anadromous Fish Habitat				0.31	Summer streamflow is critical to supporting this group's productivity and diversity.	ResFish Score2

Connectivity	1.00	OutDur	ConnectivLF
Surface Storage	0.15	AVERAGE(Aspect, Depth, Soil)	ClimateLF
Groundwater Input	0.25	AVERAGE(Groundw, Wettype)	GpC_2

Function Score for Low Flow Augmentation	F	2.17	OutDur * [(2*GroundwaterInput + SurfaceStorage)/ 3]
Benefits Score for Low Flow Augmentation	B	5.75	AVERAGE[ShedPos, AVERAGE(InvScore, AnadScore, ResFishScore)]

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Water Cooling		The effectiveness for maintaining or reducing temperature of downslope waters.	WC					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.00	North-facing wetlands are likely to be more shaded and thus cooler and more capable of contributing cool water to downslope water bodies.	Aspect7
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	1	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	1	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	When water remains entirely belowground, water temperatures in summer remain cooler than if exposed aboveground.	SatPct7
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				0.50	Shade from vegetation and other features is an important factor in cooling surface water and runoff before it reaches water bodies farther downstream (e.g., Rounds 2007). A study of many Seattle-area wetlands found that summertime temperatures ranged higher in wetlands that were characterised by relatively large open pools that lacked shade (Reinelt & Horner 1990). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if water is present only seasonally.	Shade7
		<5% of the water is shaded, or no surface water is present then.	0	0	0			
		5-25% of the water is shaded.	0	1	0			
		25-50% of the water is shaded.	1	2	2			
		50-75% of the water is shaded.	0	3	0			
		>75% of the water is shaded.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.17	Wetlands with greater water depth overall tend to have cooler outflows (depending on elevation of the outlet) because water depth provides insulation from solar warming. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth7
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	6	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Where most of the surface water is ponded, it is more likely to be heated by the sun than if distributed in the channels or residing underground. *This indicator is used only if some persistent surface water is present in the AA. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry7
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Ponded water that is open and unvegetated it is more likely to be heated by the sun. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	OpenPonded
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater discharging into wetlands supports a wetland's capacity to cool surface runoff during summer, because groundwater in most cases is cooler than surface water during that time (Mellina et al. 2002). In this region, cooler stream temperatures are associated with a greater proportion of groundwater-discharging wetlands in stream headwaters (Monk et al. 2013).	Gwater7
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.70	Wetlands that contribute cooler water to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow (and thus their temperature) that is affected by wetlands there is likely to be greater than in lowlands.	ShedPos7
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.67	The need to cool surface waters is likely to be greatest at locations where much of the contributing area is clearcut or paved, thus generating warmer inputs to streams.	Imperv7
		<10%.	0	0	0			
		10 to 25%.	1	2	2			
		>25%.	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				1.00	The need to cool surface waters is likely to be greatest where streams are south-facing and thus are exposed longer each day to warming sunlight. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its apparent contributing area.*	Aspect7v
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	1	2	2			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	1	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	The need to cool surface waters is likely to be greatest at locations that are the region's warmest.	Warmth7
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Wetlands that are narrower than the channel, lake, or estuary they adjoin are likely to have much less effect on water temperature in those receiving waters.	Fringe7b
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Wetlands that have no outflow are likely to have only minimal effect on temperature of other water bodies.	OutDur7
		Persistent (surface water flows out for >9 months/year).	1	5	5			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	1			1.00	Unshaded input streams provide more opportunity for wetlands to cool the water. Streams whose contributing areas have a greater extent of roads (road density) have higher temperatures. A study of 104 streams in British Columbia found there is a 6-in-10 chance that the summer maximum weekly average water temperature will increase by 2.3 degrees F if road density in the contributing area exceeds 27 ft of road per acre and by 5.8 degrees F if road density exceeds 53 ft of road per acre (Nelitz et al. 2007). However, overall vegetation patterns in a watershed frequently have an equal or greater influence on stream temperature and aquatic productivity than vegetation just within buffer areas adjoining a stream (Brosofske et al. 1997, Sridhar et al. 2004, Stephenson & Morin 2009). One study found that maximum air temperature within a 100-ft wooded buffer was only slightly cooler than in a 16-ft wide wooded buffer (Meleason & Quinn 2004). Vegetated buffers along north-south streams in British Columbia are more effective than those oriented east-west (Gomi et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland has no input tributary.*	ShadeIn7
	Function Score for Anadromous Fish Habitat					0.45	Anadromous fish in this region are highly sensitive to warm temperatures, so wetlands that cool or maintain natural water temperatures could be considered more valuable.	AnadFish7

Function Score for Water Cooling	F	4.53	IF((AllSat1=1), Gwater, ELSE: AVERAGE(Gwater, Shade, OpenPonded, Depth, ISOdry, SatPct)))
Benefit Score for Water Cooling	B	5.72	IF(Fringe=1), 0, OutDur X [AVERAGE(ShadeIn, ShedPos, Aspect, Imperv, Warmth) + AnadFish] /2

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Sediment Retention & Stabilisation	The effectiveness for intercepting and filtering suspended inorganic sediments, thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilising underlying sediments or soil.	SR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981). Here, wetland area is used as a surrogate for wetland volume.	WetPctCA2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Longer flow paths within a wetland allow more time and opportunity for suspended sediments to be deposited.	FlowDist2
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, and thus deposition of sediment suspended in runoff, is potentially greater in areas where water and soils do not remain frozen for long periods. Wetlands tend to be ice-covered for shorter duration, thus reducing the erosion of sediment from their shorelines as a result of ice scour. Mean annual temperature is one indicator of the likelihood of this condition.	GDD2
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.40	Dense vegetation offers frictional resistance to water flow, promoting sedimentation of suspended particles, as well as reducing the resuspension of bottom sediments by waves and currents.	Gcover2
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	5	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	2	2			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more sedimentation to occur, although usually only to a minor degree.	Girreg2
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	As a wetland's surface water area expands seasonally, water velocity is often reduced due to increased friction, and material suspended in the expanding water body is more likely to be deposited. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct2
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	3	3			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.50	Suspended sediment is more likely to be filtered and stranded in vegetation if water levels fluctuate. However, in some soil types, large water level fluctuations cause erosion that results in more sediment being exported than retained. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if surface water is permanent (i.e., must have at least a seasonal-only zone in order to have water fluctuation).*	Fluc2
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper waters usually imply slower water velocity, longer water detention time, more space for storing deposited sediments over time, and reduced likelihood of deposited sediments being resuspended by wind mixing or currents (Evans & Rigler 1983, Nolen et al. 1985). However, vegetation density is usually greater in shallow wetlands, providing other opportunities to filter and stabilize (with roots systems) suspended sediments. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthC2
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding allows more time for suspended sediment to settle out. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Ponding2
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					As the proportionate area of emergent and other aquatic plants increases, current velocity may be reduced (depending on the distribution of the plants relative to flow paths), and a larger proportion of the sediment may be intercepted, particularly if the wetland is not narrow. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov2
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.43	Wider vegetated areas provide more area for sediment particles borne in runoff to be filtered and deposited. Knutson et al. (1981) found that emergent wetlands wider than 30 feet reduced wave energy by 88% while those less than 6 feet wide were relatively ineffective in wave buffering. Many studies have shown that sediment retention is greatest in the first 5-20 ft of a buffer, that is, the most uphill portion, which is closest to potential inputs of runoff-borne sediment (Polyakov et al. 2005, White et al. 2007). However, this depends on steepness of the terrain, erodibility and infiltration capacity of the soil, ground cover, antecedent soil saturation, sediment particle size, and runoff intensity. Wider buffers are required when runoff carries finer-sized particles (e.g., clay). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthAbs2
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	1	3	3			
		30 - 49 m.	0	4	0			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	Wetlands whose shorelines have gentle slope are more likely than those with steep ones to retain sediment runoff from adjoining uplands, and are likely to have more vegetation that facilitates this. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	WatEdge Slope2
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation should allow more contact between plants and moving sediment-bearing water, resulting in greater deposition of suspended sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if there is no ponded water, or if ponded water but no vegetation, or if ponded but no open water.*	Interspers2
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain all sediment that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less sediment annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDur2
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for suspended sediments to be deposited. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of sediment (Amatya et al. 2003). *In calculations, is excluded automatically (cell goes blank) if no outlet. In calculations, is excluded automatically (cell goes blank) if wetland has no surface water outlet.*	Constric2
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.38	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus sedimentation, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment to be deposited. The sinuosity is as much the result of sedimentation-erosion dynamics as it is the cause of them. Wetlands with a sheet flow pattern often retain more suspended solids than channelised systems because interception and resistance is greater (Morris et al. 1981). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.	ThruFlo2
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	3	3			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	6	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	4	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50		Gradient2
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	If soil or sediment within a wetland is eroding, the wetland is unlikely to be trapping incoming suspended sediment. *In calculations, is ignored (cell goes blank) if wetland soil is currently intact, but is scored as a negative if disturbance is occurring.*	

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive sediment from upslope is entering a wetland, this provides more opportunity for the wetland to trap sediment and associated metals and hydrocarbons. This increases the value of any retention capacity that the wetland provides. High levels of incoming suspended sediment often correspond with high levels of other pollutants.	ToxUp2
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	ToxData2
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Wetlands with large contributing areas are likely to receive more suspended sediment and thus have more opportunity to trap sediment, which potentially increases their value as protectors of downstream water quality.	CApct2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.50	The need for (and value of) sediment-trapping capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, as occurs when much of the contributing area contains unvegetated surface. However, a study in Alaska that compared total sediment yield in channels surrounded by old-growth, clear cut, and young alder found no significant difference in sediment yield (Gomi & Sidle 2003). In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.	ImpervPctSS
		<10%.	0	0	0			
		10 to 25%.	1	1	1			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				1.00	The need for (and value of) sediment retention that potentially could be provided by wetlands is greater when upland sediment loads are not being retained or rerouted by features closer to the sediment source. If runoff is diverted away from downslope wetlands, such as in road ditches or drainage tile, then those wetlands will become drier. When they do, they will have less opportunity to receive water with suspended solids (Wigington et al. 2005, Hogan & Walbridge 2007). Even when runoff is not diverted from the wetlands, if the volume of runoff entering a wetland per unit time increases, the wetland will be less effective in treating the runoff. That is because increased runoff will often cause tiny channels to develop within the wetland, or will increase the dimensions of existing ones. These factors will decrease the detention time and pollutant contact with vegetation, because most of the vegetation will be positioned apart from the water flowing through in the small channels (McBride & Booth 2005, Alberti et al. 2007). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	TransportSS
		Mostly true.	1	2	2			
		Somewhat true.	0	1	0			
		Mostly untrue.	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.00	There is more opportunity for suspended sediments to be trapped by a wetland (and thus more value to this function) if the wetland contains surface water which facilitates transport of suspended sediment. into the wetland.	SatPct2
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	6	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	1	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2				
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Large water level fluctuations pose the possibility of increased shoreline erosion, which can be partly alleviated by wetlands, thus making those wetlands more valuable as shoreline stabilizers.	MaxFluc2
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Used as a classifier.	Inflo2
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.75	Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of sediment. Their sediment-trapping role could thus be considered to be more essential and valuable than if vegetated buffers were adequate to perform the same function.	CAnatPct2
		<5%.	0	4	0			
		5 to 30%.	1	3	3			
		30 to 60%.	0	2	0			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Increased slope in a watershed or buffer strip results in more erosion and greater transport of soil particles to downslope wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), and Nieswand et al. (1990). Sediment export from sloping lands mostly begins at about 10% slope and increases as slope becomes steeper (Zhang et al. 2010). Greater sediment loads associated with steeper slopes increase the opportunity for wetlands to trap that sediment, thus increasing their value in protecting waters further downslope. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area or the last choice was selected in the previous question.*	BuffSlope2
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	4	4			
		>30%.	0	6	0			
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.58			0.58	Because actual data on sediment loads are lacking for many wetland watersheds, this approximation is included as well, and is based on a host of activities known in some cases to contribute excessive sediment, e.g., wetland ditching (Pavey et al. 2007).	Erodible2

Live Store	0.63	IF(AllSat1=1),"", AVERAGE(Fluctua, SeasPct)	LiveStore2
Entrain	0.43	IF(AllSat1=1),"", AVERAGE(OutDura, FlowDist, Depth, Ponding, Constric, WatEdgeSlope)	Entrain
Dry Intercept	0.62	AVERAGE[Gradient, WetPctCA, AVERAGE(Girreg, Gcover, SoilDisturb)]	DryIntercept
Wet Intercept		IF(AllSat1=1),"", IF(NoPonded=1),"", ELSE: AVERAGE (Width, AVERAGE(GDD, Thruflo, AqPlantCov, Interspers))	WetIntercept

Function Score for Sediment Retention & Stabilization	F	5.57	(IF((AllSat1=1), DryIntercept, IF((NoOutlet=1), 1, (2*AVERAGE(Entrain, LiveStore2) + AVERAGE(DryIntercept, WetIntercept))/3)))
Benefits Score for Sediment Retention & Stabilization	B	5.35	MAX(ToxData, ToxUp, AVERAGE(Inflo, SatPct, AVERAGE(ImpervPctSS, ErodibleSS, CAnatPct, BuffSlope, CApct, TransportSS, MaxFluc)

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Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season) as a result of chemical adsorption, or from translocation by plants to belowground zones with less potential for physically or chemically remobilizing phosphorus into the water column.	PR						
#	**Function Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition (and P-retention, which sometimes correlates with that) increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981).	CApctB3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Phosphorus retention often correlates with detention time, which in turn correlates with flow path length within a wetland.	FlowDist3
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, which enhances deposition of sediment-bound P, is potentially greater in areas where water and soils do not remain frozen for long periods. However, cold temperatures slow the decomposition of plant material and increase the retention of P in accumulating peat.	GDD3
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	Dense vegetation offers frictional resistance to runoff, promoting sedimentation of suspended particles and reducing erosion. This promotes phosphorus retention because phosphorus is typically adsorbed to soil particles.	Gcover3
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	3	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more deposition of phosphorus-containing suspended sediments to occur, although usually only to a minor degree.	Girreg3
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.60	Long-term retention of phosphorus can occur when soil or sediment contains high concentrations of aluminum or iron, mainly at low pH (Richardson et al. 1985), and to a lesser extent, calcium at higher pH (Bridgham et al. 1996). Aluminum occurs most commonly in organic and clay soils. Phosphorus is also retained in wetlands via plant uptake, but in organic soils, acidic conditions can inhibit plant capacity to take up and retain phosphorus (Prescott et al. 2000) and in most cases, this represents only a temporary retention..	SoilTex3
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	3	3			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Lacustrine wetlands are more likely than bogs or fens to be phosphorus-limited (Walbridge & Navaratnam 2006), and thus should be more able to take up and retain phosphorus.	Lake3
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Sites that remain continually moist (saturated) but not flooded may be more likely to retain phosphorus (Aldous et al. 2007).	SatPct3
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	In some cases, sediments that remain covered with water year-round (and longer) tend to become anaerobic and release phosphorus, especially in deeper wetlands. Thus, wetlands with the least extent of persistent water may be most retentive of whatever P they receive. On the other hand, seasonal drawdowns can mobilize phosphorus that has accumulated in sediments (Snyder & Morace 1997, Aldous et al. 2005). To a perhaps lesser extent, reflooding of soils that have been dry for extended periods also can mobilize phosphorus, especially if flooding creates anoxic conditions (Burley et al. 2001), or if large quantities of leaf litter and other organic matter are present and rapidly decompose or leach phosphorus. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Persis3
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Wetting and drying of sediments, as happens especially in wetlands with large water level fluctuations, increases the leaching and desorption of phosphorus from sediment organic matter, thus resulting in net export. However, stable water levels also can promote phosphorus export (not retention) because they are often associated with anoxic conditions that result in increased mobility of phosphorus. Sediment P release and subsequent export is particularly strong during periods of seasonal anoxia (Burley et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu3
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper wetlands are more likely to experience anoxic conditions that promote P mobility and export. However, deeper waters also imply slower water velocity, longer water detention time, more time for biological processing of phosphorus, and reduced likelihood of phosphorus associated with deposited sediments being resuspended by wind mixing or currents. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DomDepth3
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	5	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up phosphorus from sediments (and some, from the water directly) and can facilitate long-term retention if P is transferred to roots that are not as subject as the foliage is to leaching the nutrients back into the water column. Plants also facilitate sediment deposition by slowing the water, and much phosphorus is adsorbed on that sediment so is also deposited and potentially retained. However, their decaying foliage also frequently creates anoxic conditions that promote P release from sediments, if iron concentrations are low and aeration by currents and wind is poor (as tends to occur when emergent and submersed aquatic plants occupy most of a water body). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov3
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	4	0			
		70-99% of the ponded water.	0	3	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.43	Wider vegetated areas provide more area for phosphorus adsorbed to sediment particles in runoff to be filtered and deposited. Where phosphorus is mainly attached to sediment (as often it is), then buffer widths sufficient for sediment retention (generally 10-30 ft) may be almost as effective for retaining phosphorus (White et al. 2007). But if phosphorus is mostly in dissolved form (orthophosphate, or soluble reactive phosphorus), then vegetated buffers may need to be very large or may not be effective at all (Prepas et al. 2001, Hoffman et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VegWabs3
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	1	3	3			
		30 - 49 m.	0	4	0			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater sediment and phosphorus removal. That is because plants assist the deposition of suspended sediment which contains P, while open water areas tend to be more aerobic which immobilizes P in the deposited sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, or if ponded but no open water.*	Interspers3
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				A proliferation of algae and floating aquatics can indicate that the wetland is receiving more nutrients than it is capable of processing effectively. These non-rooted plants do not oxygenate the sediments, they take up and store nutrients only briefly, and their die-offs create anoxic conditions that mobilize phosphorus temporarily retained in sediments. In the calculations, abundant algae reduces the score but absence of blooms does not increase it. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Algae3
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain all phosphorus that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less phosphorus annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura3
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for sediments to be deposited and phosphorus to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of phosphorus (Amatya et al. 2003).	Constric3
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.25	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow phosphorus adsorbed to sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus may be more effective at allowing sediment to be deposited, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the phosphorus associated with it to be deposited. Wetlands with a sheet flow pattern often retain more total phosphorus than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo3
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:					Acidic conditions (indicated by staining) potentially support greater adsorption of P by iron and aluminum (Richardson et al. 1996, Sutmm & Morgan 1996) and that is often associated with the dissolved organics that cause staining (Gorham et al. 1998). Acidic conditions also slow the decomposition of plant material, thus increasing P storage in peat. P retention can also occur at high pH as a result of precipitation with calcium. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. Otherwise, retention is assumed to increase below a pH of 5 or above a pH of 9.*	Stain3
		Was measured, and is: [enter the reading in the column to the right.]	6.3					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.75	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the phosphorus that is associated with it. Ground cover becomes more important to sediment stabilization in wetlands on slopes.	Gradient3
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	3	3			
		6-10%.	0	2	0			
		>10%.	0	0	0			
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0			0.00	P retention is expected to be considerable in calcareous fens because soluble P is precipitated by calcium when pH is basic, and those conditions typify calcareous fens..	CalcFen3

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardize	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive phosphorus from upslope is entering a wetland, this provides more opportunity for the wetland to retain P and thus increases the value of any P-retention that the wetland provides. High P levels often correspond with high levels of other pollutants.	PsampUp3
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	PsampDown3
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Phosphorus commonly adsorbs to suspended sediment, and wetlands that comprise a large proportion of their contributing area are more effective for retaining sediment in runoff, and thus phosphorus.	CApct3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.50	The need for (and value of) phosphorus retention capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and associated P. This occurs when much of the contributing area contains impervious surface. Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of phosphorus. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 40% more phosphorus to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	ImpervCA3
		<10%.	0	0	0			
		10 to 25%.	1	1	1			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				1.00	The need for (and value of) phosphorus retention that potentially could be provided by wetlands is greater when upland phosphorus loads are not being retained by features closer to the phosphorus source. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	Transport3
		Mostly true.	1	2	2			
		Somewhat true.	0	1	0			
		Mostly untrue.	0	0	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of sediment and adsorbed phosphorus, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflo3
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of P are commonly associated with higher levels of conductivity and TDS. Higher P concentrations indicate more opportunity for the wetland to retain P, thus making its provision of this service more valuable to downstream waters. In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. In calculations, is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.	Conduc3
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater in many areas is phosphorus-rich, especially when associated with iron-rich bedrock. This increases the opportunity of the receiving wetlands to process the P, thus increasing the importance (value) of their role in the local ecosystem.	Groundw3
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.75	Riparian buffers (in contrast to vegetation and other features located far from streams) can be responsible for up to 70% of the reduction in nutrient loads to streams (Diebel et al. 2009, Roberts & Prince 2010), so a lack of an adequate buffer increases the opportunity (and thus value) for a wetland to process nutrients.. However, many factors other than buffers control a wetland's water quality. These include underlying soils and geology, groundwater discharge or recharge rates, topography, plants and animals within a wetland, and proximity to the ocean (Feller 2005).	NatCApct3
		<5%.	0	4	0			
		5 to 30%.	1	3	3			
		30 to 60%.	0	2	0			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Wetlands that receive suspended sediment in runoff from steep slopes are more likely to retain it because of the large differential in current velocities, which promotes deposition in the wetland. This increases the opportunity of the wetlands to process the P, thus increasing the importance (value) of their role in protecting downslope waters from overenrichment. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	BuffSlope3
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	3	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	0			0.44	Because actual data on phosphorus loads are lacking for many wetland watersheds, this approximation based on a host of phosphorus-generating activities is included as well.	Pload3

Frozen Duration	0.13	GDD	FreezeDura3
Intercept Dry	0.64	AVERAGE(Gradient, FlowDist, AVERAGE(Girreg, Gcover, CApctB))	IntercepDry3
Intercept Wet		IF(AllSat1=1),"", IF(NoPonded=1),"", AVERAGE (Width, MAX(Thruflo, AqPlantCov, Interspers))	IntercepWet3
Connectivity	0.38	AVERAGE(OutDur, Constric, Gradient, FlowDist, Lake)	Connec3
Adsorption	0.30	AVERAGE(SoilTex, Stain, CalcFen)	Adsorb3
Desorption	0.60	AVERAGE(SatPct, Persis, DomDepth, Fluctu)	Desorb3

Function Score for Phosphorus Retention	F	4.12	IF((AllSat1=1), AVERAGE(IntercepDry, Adsorb, FreezeDura), IF((NoOut=1), 1, ELSE: (3*AVERAGE(Adsorption, Desorption) + 2*Connectivity+ (AVERAGE(InterceptWet, InterceptDry) + FreezeDuration) / 7
Benefits Score for Phosphorus Retention	B	7.71	[MAX(Pload, PsampUp, PsampDown, AVERAGE((Inflo, AVERAGE(BuffSlope, CApct, Transport, Groundw, ImpervCA, NatCApct))

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Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas, primarily through the microbial process of denitrification, while generating little or no nitrous oxide (a potent greenhouse gas).	NR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF16	Upland Edge Contact	Select one:				1.00	Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, proportionally longer (i.e., convoluted) edges should provide the most opportunity for removal of nitrate via denitrification.	UpEdge Shape4
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	1	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	4	4			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.70	A disproportionate amount of the nitrate introduced to a watershed is processed in headwater areas rather than in downstream lowland areas (Krause 1982). However, where headwaters are at regionally high altitudes, the cooler temperatures and shorter growing seasons can potentially restrain denitrification.	Elev4
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Where a wetland comprises a large proportion of its catchment, nutrient loading is more likely to occur at rates and levels that can be processed effectively.	WetPctCA4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				1.00	Soil temperatures are warmer for longer on south-facing slopes, and this is essential for denitrification which removes soluble N (Kim et al. 2007). However, those soils should not be dried out to less than 70% saturation by those warmer conditions (Hefting et al. 2006).	Aspect4
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	1	2	2			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	1	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	N removal often correlates with detention time, which in turn correlates with flow path length within a wetland.	FloDist4
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Microbes responsible for most of the nitrate removal in wetlands thrive best at warmer soil or sediment temperatures. In contrast, freeze-thaw cycles in wetlands are often characterized by change from aerobic to anaerobic conditions, which can mobilize nitrate in sediments, making the nitrate vulnerable to being exported downstream. Also, wetlands that are frozen for long periods are generally in regions with shorter growing seasons, resulting in less opportunity for biological uptake of nitrate.	Warmth4
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Floodplain wetlands are notably effective for removing N via denitrification and that process is limited by available carbon more than it is in bogs (Pinay et al. 2003). Bogs are typically nitrogen-poor (Heilman 1966) and thus are able to rapidly take up much of the nitrate that reaches them. Their acidic conditions inhibit generation of nitrous oxide as well as inhibiting nitrification (Dammann 1988) and the removal of nitrate via denitrification (Pinay et al. 2003). Denitrification is more prominent in fens and marshes than in acidic bogs. Bogs tend to cycle nitrogen internally and remove added N (Li & Vitt 1997, Bayley & Mewhort 2004), although due to acidic conditions and other factors, mosses in some wetlands have less capacity to take up apparently available N than do vascular plants (Heijmans et al. 2002, Berendse et al. 2001). Forested wetlands, especially those with an alder component or on slopes, may have less capacity to remove N via denitrification and may actually add nitrate via N fixation (Fellman & D'Amore 2007).	Wettype4
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	1	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0			0.00	Denitrification may be less under evergreen canopies than under deciduous because of the more shaded (cooler) microclimate and acidic soil conditions of the former.	WoodyTyp4

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	Less canopy cover increases soil warming in spring which could accelerate denitrification, a major process for removing nitrate. However, tree roots can extend the subsurface zone of denitrification by oxidizing deeper subsurface areas. Trees also take up and temporarily retain nitrate, as well as adding carbon to the soil, which promotes denitrification. Therefore, a balanced interspersed mix of shading woody and non-shading herbaceous vegetation is hypothesized to enhance N removal.	TreeCanop4
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	Dense vegetation offers frictional resistance to runoff, promoting deposition of organic nitrogen and resisting erosion of N-containing sediments. Vegetation takes up nitrate at least seasonally and plant roots can promote denitrification by providing a carbon source (Lin et al. 2002) and oxidizing otherwise anoxic subsurface soils (Brix 1994). However, shade from plants reduces soil temperature which slows the denitrification rate (Hogg & Lieffers 1991), and emissions of harmful nitrous oxide can be greater in wetlands with denser vegetation.	Gcover4
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	3	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	These features cumulatively decelerate runoff, thus allowing for more biological processing and deposition of nitrate-containing suspended sediments, although usually only to a minor degree. The presence of soil cracks implies a potential downward extension of the aerobic zone, interspersing it with anaerobic areas, which should lead to greater denitrification. Studies of wastewater treatment wetlands have shown greater nitrate removal where pockets of deeper water are interspersed with shallower areas (i.e., diverse microtopography).	Girreg4
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	2	0			
		Several (extensive micro-topography).	1	3	3			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, if inclusions of aerobic non-wetland soils are numerous and interspersed throughout a wetland, the extent of denitrification overall should be greater.	Inclus4
		Few or none.	1	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	0	1	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.75	Denitrification rates are often limited by the amount of available carbon (Groffman et al. 2009, Capps et al. 2014). Organic soils have the most carbon, and coarse soils usually have the least. Denitrification enzyme activity, on a per gram basis, is typically greater in organic soils than mineral soils (Van Hoewyk et al. 2000). However, the acidic nature of many organic soils can limit denitrification, the major process for nitrate removal. Soils having less than 65% silt and clay have very limited capacity to remove nitrate via denitrification (Pinay et al. 2003). Emissions of nitrous oxide (a detrimental greenhouse gas) are most likely to occur in soils that are poor in organic matter but rich in nitrogen (e.g., the carbon-nitrogen ratio is less than 25, Hunt et al. 2007). The 40 cm threshold represents a frequent transition zone in some soil types from aerobic to anaerobic conditions; in other soils the transition occurs at about 25 cm	SoilTex4
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	4	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	3	3			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	0	3	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.50	Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008) .	SatPct4
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Exposing sediments to the air can speed decomposition and cause them to release accumulated nitrate, potentially resulting in less removal. In contrast, long-duration flooding makes sediments anaerobic, which is necessary for the denitrification process (Westermann & Ahring 1987). Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct4
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				1.00	Denitrification rates are higher in vernal pools and other areas with that are inundated only seasonally, as compared with drier upland forests (Capps et al. 2014). Denitrification occurs at the interface between aerobic and anaerobic conditions, and such conditions often develop where a ponded area expands seasonally into vegetated areas. In addition, levels of soil organic matter are often higher in seasonal wetlands than in permanently inundated ones of comparable extent (Shaffer & Ernst 1999), and organic matter is key to supporting denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct4
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	4	4			
		>95% of the AA.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Wetting and drying of sediments, as happens especially in wetlands with large and frequent water level fluctuations (because a wider area is subject to wetting-drying and associated aerobic-anaerobic shift), increases the loss of nitrate via denitrification (Groffman & Hanson 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu4
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponded conditions provide longer time for nitrate processing, as well as causing sediments to lose oxygen, thus creating a microclimate favorable for denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondPct4
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing.	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up nitrate from sediments and can facilitate retention if N is transferred to roots not as subject to erosion as foliage. Plants also facilitate sediment deposition by slowing the water, and some nitrate is associated with that sediment so is also deposited and potentially retained. Perhaps most importantly, roots of some plants oxidize the anoxic sediments that surround them and this facilitates denitrification, the major process for removing soluble nitrate from water. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov4
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Wider vegetated areas provide more area for biological processing of nitrate, and for nitrate adsorbed to sediment particles in runoff to be filtered and deposited. The most comprehensive and sophisticated analysis that used statistical procedures (meta-analysis) to synthesize results from over 60 peer-reviewed studies of nitrate removal by buffers in temperate climates found that widths of approximately 10 ft, 92 ft, and 367 ft are needed to achieve 50%, 75%, and 90% removal efficiencies for nitrate (Mayer et al. 2005, Mayer et al. 2007). This assumed that most inputs are through subsurface flow. When surface flow dominates (as often occurs during storms, and where subsurface storm drains have been installed around homes), buffers of 109 ft, 387 ft, and 810 ft are needed to achieve the same removal efficiencies (Mayer et al. 2005). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs4
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater nitrate removal. That is because open water areas tend to be more aerobic, whereas densely vegetated areas often are anaerobic, except where plant roots oxidize a small part of the sediment. The combination of anaerobic and aerobic areas in close proximity facilitates nitrate loss through denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers4
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.17	Wetlands that lack outlets retain or remove all nitrate that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less nitrate annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura4
		Persistent (surface water flows out for >9 months/year).	1	1	1			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for nitrate to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric4
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.25	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow more time for biological processing of nitrate. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the nitrate associated with it to be deposited. Increased channel complexity also implies greater interspersion of open water and vegetation (see above) and in some cases, more hyporheic flow -- both of which favor nitrate removal. Wetlands with a sheet flow pattern often retain more nitrate than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo4
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	pH is a strong predictor of denitrification in wetlands (Morse et al. 2012). Other factors being equal, the optimal pH for denitrification is 7 to 8.5, whereas a sharp decline occurs at a pH of less than 6 or greater than 8.5 (Simek & Cooper 2002). Acidifying Sphagnum mosses are most common below a pH of 5.5 (Vitt 2006). *In calculations, is excluded automatically (cell goes blank) if last choice selected and is set to 0.5 if second choice is selected. If pH is 6.0-8.5, score is set to 1, while outside this range is 0 This formula recognizes diminished rate of denitrification as pH becomes more acidic or basic.*	Acid4
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Many studies have highlighted the importance of subsurface (hyporheic) flow, or groundwater discharge, to denitrification rates in both riverine and non-riverine (e.g., Kroeger & Charette 2008) wetlands. Groundwater in many regions is iron-rich, and addition or removal of nitrate can significantly affect the ecological mobility of iron and perhaps some other metals in wetland soils (Shrestha et al. 2011).	Groundw4
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the nitrate that is associated with it, and also supporting anaerobic conditions that lead to more nitrate removal via denitrification. Steeper gradients in a wetland imply greater potential for outflow and transport downslope, and more aerobic conditions.	Gradient4
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Constructed (and some restored) wetlands typically have lower soil organic matter (Shaffer & Ernst 1999), and that deficit limits the denitrification that otherwise removes nitrate. Thus, new wetlands would be expected to release the more nitrate to downstream waters. However, the proportion of incoming nitrate that is exported in some cases is greater in soils that are more fertile, i.e., nearing nitrate saturation, with a C:N ratio lower than 25 (e.g., Gundersen et al. 2006).	NewWet
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	0.33			0.67	Soil compaction seals up pores in the soil that serve as habitat space for denitrifying bacteria, as well as causing a larger proportion of the precipitation to leave as runoff rather than infiltrate into subsurface areas where denitrification is greatest. Soil erosion often results in loss of carbon-rich upper soil layers that are important to denitrification.	SoilDisturb4
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	Population centers, even when they do not drain into wetlands, can provide wetlands with more opportunity to remove N because population centers often generate more airborne N as a result of greater vehicle traffic, and this enters wetlands as N deposition.	PopDist4
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Vehicle emissions contain substantial N products, so road traffic often results in increased nitrogen deposition in wetlands. This increases the opportunity for N-removal, and thus the value of a wetland's capacity for N removal. Also, N removal efficiency increases exponentially with N deposition (especially when deposition is 0.25 to 0.50 g of N per year (Bragazza et al. 2004).	RdDist4
		<10 m.	1	5	5			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	1	1	1			
		>500 m.	0	0	0			
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0			0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	GWsens
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive nitrate from upslope is entering a wetland, this provides more opportunity for the wetland to remove N and thus increases the value of any N-retention that the wetland provides. High nitrate levels often correspond with high levels of other pollutants.	NsampUp
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	NsampDown
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	See the above. This indicator is highly correlated to it but is not identical.	Capct4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.50	The need for (and value of) nitrate removal capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and nitrate from other sources, as occurs when much of the contributing area contains impervious surface.	Imperv4
		<10%.	0	0	0			
		10 to 25%.	1	1	1			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				1.00	The need for (and value of) nitrate removal that potentially could be provided by wetlands is greater when upland nitrate loads are not being retained by features closer to the nitrate source. Vegetated buffers are more effective in protecting the quality of wetlands when most water enters the wetland as shallow subsurface lateral flow or discharging groundwater, rather than channel flow or surface runoff (Dillaha et al. 1989, Dosskey et al. 2001, Wigington et al. 2003, Mayer et al. 2005). Buffers in rural New York were found to be ineffective when crossed by small unmapped drainageways (e.g., roadside ditches) that were not buffered but were connected to pollution sources (Madden et al. 2007).	Transport4
		Mostly true.	1	2	2			
		Somewhat true.	0	1	0			
		Mostly untrue.	0	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Total available nitrogen in soil increases with increasing density of nitrogen-fixers such as red alder (Sanborn et al. 2002, Cortini & Comeau 2008). Consequently, wetland contributing areas with a large proportion of alder often export more nitrate to wetlands (Compton et al. 2003, Cairns & Lajtha 2005, Shaftel et al. 2012, Greathouse et al. 2014). Because this provides wetlands with increased opportunity to process the N, it increases the value of their role in the local ecosystem.	Nfix4
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	4	4			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of nitrate from upland sources into wetlands, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflow4a
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of N are commonly associated with higher levels of conductivity and TDS. Higher N concentrations indicate more opportunity for the wetland to remove N, thus making its provision of this service more valuable to downstream waters. *In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.*	Conduc4
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter	0					
		Neither of above	0					
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.75	Other factors being equal, wetlands surrounded by little natural cover tend to receive higher loads of nitrate. Their nitrate removal role could thus be considered to be more essential and valuable for protecting waters further downstream. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 54% more nitrate to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009).	CAnatPct4
		<5%.	0	4	0			
		5 to 30%.	1	3	3			
		30 to 60%.	0	2	0			
		60 to 90%.	0	1	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	Pavement and other impervious surfaces facilitate transport of N-bearing runoff into downslope wetlands, thus increasing opportunities for N-removal. Increased opportunity translates into increased value of the wetland's N-removal service.	BuffCovTyp4
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.67	Increased slope in a watershed or buffer strip has been linked to increased delivery of sediment and sometimes nitrate to downgradient streams and wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), Nieswand et al. (1990). However, an Ontario study found the slope of the contributing area had relatively little effect on concentrations of nitrate and carbon in a downslope riparian area. Soil carbon was more responsible for increasing nitrate removal, and soil carbon was actually greater on steeper slopes in that study area (Hazlett et al. 2008).	BuffSlope4
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	3	0			
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:				0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	Aquifer4
		Within 0-100 m. of the AA.	0	2	0			
		100-500 m. away.	0	1	0			
		>500 m. away, or no information.	1	0	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	0			0.44	Because actual data on nitrate loads are lacking for many wetland watersheds, this approximation based on a host of N-generating activities is included as well.	Nsource4

Warmth	0.30	AVERAGE[(AVERAGE(WoodyTyp, TreeCanop, Groundw), AVERAGE(Warmth, Aspect)]	FrozDura4
Interception and/or Erosion Resistance	0.41	AVERAGE(PondPct, Width, FloDist, Gcover, Thruflo, Interspers, Elev, WetPctCA)	Intercep4
Connectivity	0.39	AVERAGE(OutDur, Gradient, Constric)	Connec4
Organic	0.77	AVERAGE(Acid, SoilTex, WetType, NewWetland, AqPlantCov, SoilDisturb)	Organic4
Redox	0.69	(AVERAGE(SatPct, Persis, SeasPct) + AVERAGE(Fluctu, UpEdgeShape, Inclusions, Girreg))/2	Redox4

Function Score for Nitrate Removal	F	5.42	IF((NoOutlet=1), 1, IF((AllSat1=1), (2*Connec + Intercep + FrozDur + Organic + Redox)/6, ELSE: (3*Redox + 2*Connec + FrozDur + Organic + Intercep)/ 8)))
Benefits Score for Nitrate Removal	B	10.00	MAX[Aquifer, GWsens, Inflo, MAX(NSource, NsampUp, NsampDown, Nfix), AVERAGE(Imperv, RdDist, PopDist), AVERAGE(CAnatPct, BuffSlope, BuffCovTyp, Transport)]

Carbon Sequestration	The effectiveness for retaining both incoming particulate and dissolved carbon, and through the photosynthetic process converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").	CS

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetland emissions of methane increase with warming temperatures (Moosavi et al. 1994, Sha et al. 2011). Although plants responsible for much of the carbon sequestration in wetlands grow fastest at warmer soil or sediment temperatures, they also decompose faster. With colder temperatures (fewer degree days), the concentration of mobile DOC in forested wetland soils and streams decreases, suggesting more immobile carbon is sequestered onsite rather than being exported downslope in groundwater (D'Amore et al. 2010).	Warmth5
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Bogs have the deepest peat layers and thus more stored carbon than more fertile wetlands (fens) (Glenn et al. 2006). Methane emissions tend to be greater from fens, marshes, and other wetlands with water table near the ground surface for long periods (Liblik et al. 1997). Swamp soils may have greater releases of methane due to their greater diurnal fluctuations in water tables resulting from tree evapotranspiration. Methane emissions may be especially large from wetlands with emergent sedges (a common feature of fens) because they facilitate translocation of methane from sediments to the air (Hines et al. 2008).	Wettype5
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.17			0.17	Fixed carbon tends to cycle more rapidly in deciduous plant litter, thus supporting less sequestration. *In calculations, is excluded automatically (cell goes blank) if woody vegetation is absent. Otherwise, score is the reciprocal of the maximum deciduous cover among the 3 height classes, adjusted to a 0-1 scale.*	DecidTree5
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.10	Larger trees represent larger stores of sequestered carbon, but younger trees fix and accumulate carbon more rapidly (Anwar 2001, Ryan 2005). In New Brunswick, natural stands of sugar maple or yellow birch are believed to sequester the most carbon (Neilson et al. 2007). However, evergreen foliage from coniferous species tends to foster acidic conditions which slow the decomposition of organic matter (Collins and Kuehl 2001), thus leading to greater carbon sequestration. Acidic conditions and/or slowly-decomposing (recalcitrant) evergreen vegetation also can repress both methane generation (Valentine et al. 1994, Updegraff et al. 1995) and methane oxidation, but not necessarily CO_2 emissions (Bridgham & Richardson 2003). Carbon can be sequestered more effectively under such conditions (Blanco-Canqui & Lal 2004). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeForm5
		coniferous, 1-9 cm diameter and >1 m tall.	0	2	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	1	0			
		coniferous, >40 cm diameter.	0	2	0			
		broad-leaved deciduous >40 cm diameter.	0	1	0			
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:				0.40	Mosses contribute at least 48% of the productivity of some wetlands. Although the rate at which bogs store new carbon is relatively low, and because mosses decompose more slowly than woody and herbaceous plants, the peat layer in bogs and fens represents a considerable amount of carbon that already has been sequestered. Peat hummocks are particularly effective for sequestering carbon (Asada & Warner 2005). On a per unit area basis, bogs and other moss-covered areas generate less methane than many other wetlands (Hines et al. 2006, 2008),	MossCov5
		<5% of the vegetated part of the AA.	0	1	0			
		5-25% of the vegetated part of the AA.	1	2	2			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.20	The presence of peat or muck implies the presence (at least historically) of a microclimate favorable to long-term retention of particulate carbon. Peat is also a poor substrate for methanogenesis (White et al. 2008) but that is also true of well-oxygenated coarse soils (Grunfeld & Brix 1999). However, in very coarse soils the annual productivity of plants is often less than in clay/ loam soils because, unless the coarse soils are flooded regularly by rivers, they tend to be nutrient-poor. Moderately coarse soils (silts, loams), especially those with a large component of soil aggregates in the 2-8 mm range (Hossler & Bouchard 2000), tend to have neutral pH and support greater plant productivity and thus more soil organic carbon.	SoilTex5
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	4	0			
		Shallow Peat or organic <40 cm deep.	0	5	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F18	Sedge Cover	Sedges (Carex spp.) and cottongrass (Eriophorum spp.) occupy:					Among wetland plants, those best known for facilitating the emission of methane from sediments are sedge and cottongrass (Marinier et al. 2004, Strack et al. 2006, Green & Baird 2012). However, one study found methane production from cattail litter was almost 3 times greater than from sedge litter (Williams & Yavitt 2010), and alder also has been found to facilitate methane emissions from wetlands (Smialek et al. 2006, Gauci et al. 2010). *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous cover, or if cover is entirely forbs.*	Sedge5
		<5% of the vegetated area, or none.	0	3	0			
		5-50% of the vegetated area.	0	2	0			
		50-95% of the vegetated area.	0	1	0			
		>95% of the vegetated area.	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Accumulation of carbon as peat is fostered by persistently high water tables or flooded conditions, due to the anaerobic and acidic conditions which slow decay of organic matter (Belyea & Malmer 2004). However, persistently high water tables also increase carbon loss from emissions of methane (Glatzel et al. 2004, Keller et al. 2004, Pelletier et al. 2007, Altor & Mitsch 2008) and occasionally CO_2, although a Saskatchewan study found greater methane release from wetlands flooded for short periods each year than from those flooded semi-permanently (Pennock et al. 2010). Methane emissions in one study occurred mostly when water content of the soil exceeded 25% (Smith et al. 2000). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct5
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	At least in riverine wetlands, overall "average" methane emission from hydrologically pulsed sites may be less than that from sites where inundation is permanent (Mitsch et al. 2005, Altor & Mitsch 2008). Flooding from seasonally connected water bodies also promotes greater plant productivity, which provides more organic matter that potentially can be stored. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct5
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	3	3			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Very large water level fluctuations can reduce plant productivity and increase the release of methane. Maintaining steadily moist conditions (i.e., little or no water level fluctuation) may minimize methane releases (Tuittila et al. 2000, Price et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu5
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	Waters that are persistently deeper than 2 ft, and especially deeper than 6 ft, usually support much less vascular plant production which otherwise could be sequestered while acidifying the soil and thus dampening methane emissions. In a flooded pasture of wild hay, plant production declined if continual flooding exceeded 50 days at a depth of 7 inches (Rumberg & Sawyer 1965). On the other hand, methane emissions can decrease with increasing depth of surface water over the range of 0 to 1m depth (Pelletier et al. 2007, Cheng et al. 2007). One study found methane emissions were greater from a lake than a bog (Edwards et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth5
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.33	Annual plant productivity (and thus potentially-storable carbon) is often less in ponded wetlands than in wetlands where periodic water circulation replenishes nutrients (Thormann & Bayley 1997). Also, methane emissions may be higher in ponded areas because such areas are more likely to develop anaerobic conditions (Magenheimer et al. 1996, Tranvik et al. 2009). Aerobic conditions can increase the proportion of plant production that is allocated to belowground tissue, which benefits carbon storage because such tissue is more likely to resist erosion and be incorporated into longterm storage in soil. However, organic matter in ponded areas is less subject than organic matter in channels to being transported downslope in floodwaters or groundwater and thus could be more likely to become incorporated into soils, resulting in carbon being sequestered. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet5
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	1	1			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	2	0			
		>95% of the water.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants, especially those in acidic environments and/or with fibrous tissue, usually add more carbon to wetlands than they lose in the form of CO2 from decomposition. They also trap and deposit particulate carbon carried into a wetland from upslope. However, decomposition of the organic matter from plants in some wetlands generates methane. Methane emissions per unit area can be high in floating mats of vegetation (Moosavi et al. 1996) and in shallow areas with dense cover of vascular plants (Smith et al. 2000, Cheng et al. 2007) whose roots facilitate the movement of methane from soils to the surface, as compared with lower methane emissions in areas of open water (Rose & Crumpton 2006) or mats of submersed aquatic vegetation (Smith et al. 2000). Nonetheless, at least in restored wetlands, the net effect on carbon balance over a projected 33-year period is sequestration (Badiou 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov5
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Wider bands of vegetation represent more biomass to be sequestered, and are more effective in trapping organic matter carried to the wetland by upland runoff. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs5
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.30	Wetlands that lack outlets retain most carbon that enters them or is produced within. However, methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Wetlands that connect to downslope water bodies for only part of the year would be expected to export less carbon annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura5
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	6	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	8	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	10	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	10	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.67	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for scarbon in suspension to settle, although methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Ditching of some wetlands may reduce methane emissions in the long term but initially accelerates the decomposition and loss of historically stored carbon. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric5
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	3	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	2	2			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F50	Groundwater Strength of Evidence	Select first applicable choice:				1.00	Where groundwater is anaerobic (as it often is) it can stimulate methane emissions, as can its usually circumneutral acidity (Updegraff et al. 1995). As a result less carbon may be sequestered in some groundwater-fed wetlands (Smemo &Yavitt 2006). However, in many wetlands groundwater also increases the levels of iron, calcium, and sulfate in surface water (Heagle et al. 2007) which can result in less methane emission. Lakes and wetlands with large groundwater inputs may have less organic matter in their sediments (Squires et al. 2006), thus generating less methane.	GroundW5
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	0	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	2	2			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of organic matter that is associated with it. However, a Pennsylvania study found that slope wetlands tended to have moderate to high rates of organic matter accretion compared with other wetland geomorphic types (Wardrop & Brooks 1998). Also, methane emissions may be less from sloping wetlands, due to greater aeration of their soils (Tauchnitz et al. 2008).	Gradient5
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					The initial sparseness of vegetation in new wetlands suggests that overall carbon stores are less than in some of the more mature wetlands with greater plant cover, diversity, and structural complexity. Aboveground production and soil organic matter have been shown to be less in lands newly restored to wetland conditions than in long-established wetlands (Fennessy et al. 2008). However, many pioneering plants in new wetlands (especially on fertile soils) grow rapidly and thus are fixing large amounts of carbon per plant per unit time. In recovering windfall areas mosses established a dense carpet on windthrow mounds within the first few decades after the disturbance and quickly sequestered carbon. They were found to comprise as much as 25% of understory plant biomass and as much as 50% of understory productivity (den Ouden & Alaback 1996).	NewWet5
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.67	Although burning potentially releases (rather than sequesters) large amounts of carbon from wetland soils, in the longer term, mosses recover within a few decades of surface burns (Kuhry 1994), and occasional surface burning can concentrate soil inorganic material in surface peat, thereby decreasing fuel quality and the likelihood of supporting severe fires in the future. Loss of soil organic matter from burning can also result in a drop in wetland surface elevation, thus promoting wetter conditions and increasing fire resistance for years post-burn (Watts et al. 2015). Although burning produces a period of minimal carbon storage immediately post-fire, vegetation recovery through succession within a few decades promotes long-term persistence of vegetation communities with greater rates of carbon sequestration than those of unburned (late successional) communities (Benscoter et al. 2012).	Burn5
		Burned within past 5 years.	0	0	0			
		Burned 6-10 years ago.	0	1	0			
		Burned 11-30 years ago.	0	3	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	2	2			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	0			0.67	Tillage, regrading, or other soil disturbances can accelerate the decay of soil organic matter rather than supporting sequestration (Waddington & Turetsky 2008). Farming of drained hydric soils is a particular concern, because such soils typically have substantial organic matter that converts to greenhouse gases when tilled and planted annually. However, tillage of compacted soils can reduce methane emissions (Willey & Chameides 2007). Despite associated soil disturbance, selective logging in forested wetlands in some cases may increase carbon sequestration, at least temporarily, if the tree stands and other components of the forest ecosystem become more productive after thinning (Li et al. 2004, D' Amore et al. 2015).	SoilDisturb5

Historical Accumulation	0.40	AVERAGE(SoilDisturb, MossCov, Wettype, Burn, SoilTex, AVERAGE(Warmth, DecidPct, DecidTree, Width, NewWetland))	HistAccum5
Slowed Decomposition	0.58	AVERAGE(Depth, AVERAGE(Freeze, Warmth, MossCov, WetType)	Productiv
Physical Accumulation	0.45	AVERAGE (OutDura, Constric,AqPlantCov, Gradient, IsoWet)	PhysAccum5
Methane Limit	0.62	AVERAGE(MossCov, Sedge, SeasPct, Fluctu, Groundw, TreeForm, PermWpct)	MethLimit5

Function Score for Carbon Sequestration	F	5.55	(2*MAX(HistAccum, PhysAccum) + Productiv +3*MethLimit) /6
Benefits Score for Carbon Sequestration	B		NOTE: No indicators addressing VALUES of this function are currently proposed because its value is diffused throughout the entire planet.

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Organic Nutrient Export		The effectiveness for producing and subsequently exporting organic nutrients, either particulate or dissolved, along with associated compounds and elements such as iron.	OE					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	Longer flow paths allow for more interaction between runoff and wetland vegetation, which potentially leads to removal and export of more decomposed organic matter.	FloDist6
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are most productive at warmer soil or sediment temperatures, and their foliage that contributes organic matter to downslope food chains decomposes most rapidly under warmer conditions (Fissore et al. 2009). Those conditions are described by increasing mean annual temperature. As soil temperatures increase, so does the concentration of DOC in forested wetland soils and streams, and in that form carbon is readily exported (D'Amore et al. 2010). The production of Sphagnum moss in particular is greater in warmer areas (Gunnarsson 2005). However, ice that is more prevalent in cooler regions can erode organic matter and aid its transport out of a wetland during ice-melt periods.	Warmth6
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Carbon from marshes and fens is often more biodegradable (and thus more exportable and valuable to food chains over a wider area) than bog and forested wetland carbon (D'Amore et al. 2010). The same may be true of riparian shrub/forest wetlands, and their connectivity to other water bodies is usually greater, potentially leading to greater export (Dalva & Moore 1991). Bogs usually have the largest amounts of carbon in storage (as peat), and some bogs fix carbon more readily than more fertile wetlands (fens) (Moore 1989, Glenn et al. 2006), but connectivity to other water bodies is generally less than other wetland types, with carbon being exported mainly in dissolved form via groundwater.	Wettype6
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	4	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Nitrogen added to a wetland by N-fixing plants can increase the wetland's overall plant productivity, potentially making more organic matter available for export. Presence of alder in conifer woodlands also can speed the decomposition of organic material from the conifers (Fyles & Fyles 1993) perhaps making it more useful for supporting aquatic life.	Nfixer6
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	4	4			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	More extensive ground cover may imply more organic matter is available for export. However, excessive litter buildup implies a lack of significant exporting forces, e.g., currents.	Gcover6
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	3	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.25	Soils with a thick organic layer have the most carbon available for export. However, moderately coarse soils (silts, loams) are better-aerated, less acidic, and thus can have greater plant productivity. Very coarse soils, unless flooded regularly by rivers, tend to be nutrient-poor thus limiting plant productivity. However, their presence may indicate periodic exposure to water currents capable of exporting carbon, and coarse soils sometimes support greater plant productivity because greater infiltration can reduce the frequency of anoxic conditions that stifle productivity of some rooted plants.	SoilTex6
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	Prolonged inundation can stifle plant productivity, whereas seasonal inundation encourages it, and is often associated with conditions that contribute to the export of organic matter, e.g., river floods. Seasonally high water levels promote decomposition (Bayley & Mewhort, 2004) and thus facilitate the export of carbon. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct6
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	3	3			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.25	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc6
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	1	1			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	3	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.80	Annual productivity is generally greater in shallower areas where light is more available and sediments are subject to aeration from wind mixing. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth6
		<10 cm deep (but >0).	0	5	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Flowing rather than ponded waters provide the most opportunity for organic matter to be exported from wetlands (Urban et al. 1989, Dalva & Moore 1991). In some regions, flowing waters also tend to be more productive because nutrients from further upstream are continually introduced into the wetland and replenished. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondedPct6
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The probability that organic matter from wetland plants will be exported increases in relation to the percent of the inundated area containing such plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov6
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	6	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.80	The plant material from narrower (fringe) wetlands is often more vulnerable to transport into adjoining waters. However, wider wetlands represent larger total stores of organic matter available for waterborne export downstream or offsite (Pacific et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs6
		<1 m.	0	4	0			
		1 - 9 m.	0	5	0			
		10 - 29 m.	1	4	4			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	2	0			
		> 100 m, or open water is absent at that time.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of open water with vegetation promotes greater export of organic matter from the vegetation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers6
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Boreal streams are an important transporter of protein-rich, labile DOM (Urban et al. 1989, Gergel et al. 1999, Xenopoulos et al.2003, Fellman et al. 2009). Thus, annual export of accumulated organic matter to downstream water can be greater in wetlands with outlets, especially those with persistent outflow. Nonetheless, even wetlands that lack outlets may export variable amounts of dissolved carbon via subsurface infiltration and "pipes" created by decayed subsurface peat and tree roots which cannot be evaluated in a rapid assessment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura6
		Persistent (surface water flows out for >9 months/year).	1	5	5			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	4	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus limiting export of organic matter. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric6
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	0	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	1	1			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Increased channel complexity implies greater interspersion of open water and vegetation, which provides more opportunity for organic matter to be in contact with moving water and thus be exported. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo6
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	1	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater-fed wetlands remain ice-free for longer, thus lengthening the growing season and plant production, and increasing the potential for organic matter to be exported if the wetland is connected to other water bodies. However, groundwater generally contains less dissolved organic carbon than does surface runoff (Emi-Fergus et al. 2011). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw6
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Steeper gradients imply a greater likelihood that whatever organic matter is produced will be transported offsite.	Gradient6
		<2% or the AA has no surface water outlet (not even seasonally).	0	0	0			
		2-5%.	1	2	2			
		6-10%.	0	3	0			
		>10%.	0	4	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Soil organic matter is slow to accumulate in constructed wetlands (Alsfeld et al. 2009), so less is likely to be available for export.	NewWet6
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Historical Accumulation	0.25	AVERAGE(SoilTex, NewWet)	HistAccum6
Current Productivity:	0.44	AVERAGE(Frozen Duration, Plant Cover, Nutrient Availability) WHERE:	Productiv6
Frozen Duration	0.13	AVERAGE(Warmth, Groundw)	FrozDura6
Plant Cover & Type	0.57	AVERAGE (AqPlantCov, Decid, DecidTree, Gcover, Depth)	PlantCov6
Nutrient Availability	0.63	AVERAGE(Wettype, SeasWpct, Fluctu, Nfix)]	NutrAvail6
Export Potential	0.69	AVERAGE [OutDura, Gradient, FloDist, AVERAGE(Constric, ThruFlo, Interspers, Width, PondedPct)]	ExportPot6

Function Score for Organic Nutrient Export	F	5.34	IF((NoOutlet6=1),0, ELSE: (3*ExportPotential+ 2*CurrentProductivity + HistoricalAccumulation) /6

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Anadromous Fish Habitat	The capacity to support rearing or spawning habitat of fish species that migrate from marine waters into freshwater streams to spawn. Catadromous species (e.g., eels that spawn in marine waters but spend most of their life in fresh) are also included.	FR						
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	If accessible and otherwise suitable for fish, wetlands closer to the coast are more likely to support anadromous species due partly to reduced duration of ice cover, shorter instream migration routes, and potentially elevated aquatic productivity.	TidalProx9
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.30	Wetlands located lower in a watershed are generally more accessible to anadromous fish.	Elev9
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					A wetland exposed to toxic substances has less or no capacity to sustain anadromous fish. Fish are especially sensitive to heavy metals such as copper (Scannell 2009).	ToxData9
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.50	Impervious areas do not contribute many terrestrial insects to aquatic food chains, may reduce aquatic productivity due to high turbidity and sedimentation of spawning areas, and can raise stream temperatures to levels harmful to anadromous fish.	ImpervCA9
		<10%.	0	2	0			
		10 to 25%.	1	1	1			
		>25%.	0	0	0			
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				1.00	Regardless of the accessibility and quality of a wetland, if anadromous fish cannot access the larger watershed of which it is a part, the wetland will be unable to currently support anadromous fish.	Access9
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	1	2	2			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Salmon are highly sensitive to water acidity and the effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	Karst9
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Of the wetland types listed, riparian and marsh wetlands are typically most important to anadromous fish because they have the most water and are the most accessible. When accessible, other wetland types are used but invertebrate foods may be less abundant due to acidic conditions.	Wettype9
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, LeSage et al. 2005). From that, it can be inferred that fish production should be higher as well, where food is limiting fish survival.	Nfix9
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	4	4			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Wetlands that are never inundated cannot support anadromous fish directly.	SatPct9
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	2	2			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Areas of persistent water within or adjoining a wetland are necessary to provide refuge, spawning habitat, and travel corridors for all anadromous fish. However, areas of a wetland that dry out seasonally are also important so wetlands that are entirely comprised of persistent water may be no more important than those that have a mix of persistent water areas and seasonally-inundated-only areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct9
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				0.60	Most anadromous fish require relatively cool waters, and shade helps maintain cool water temperatures, especially in lowland streams during low flow conditions. Cool waters (less than 68 degrees F, ideally less than 60F) are particularly important to salmonid fish because at higher temperatures less of the dissolved oxygen necessary for their survival (a minimum of 5 ppm is needed by most local fish) is able to remain in the water. However, shade also can reduce algal productivity and thus the abundance of aquatic insects, although this may be compensated somewhat by increased availability of terrestrial insects that fall off the shading vegetation and into waters where they are fed upon by fish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if water is present only seasonally, or if wetland is in the lower third of a watershed (because shade has less effect on water temperature in the wider channels there).*	Shade9
		<5% of the water is shaded, or no surface water is present then.	0	1	0			
		5-25% of the water is shaded.	0	2	0			
		25-50% of the water is shaded.	1	3	3			
		50-75% of the water is shaded.	0	5	0			
		>75% of the water is shaded.	0	4	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	Many studies have demonstrated the importance to anadromous fish of streams and wetlands that are inundated only seasonally, provided fish can enter and exit them then (e.g., Brown & Hartman 1988, Nickelson et al. 1992, Freeman et al. 2007, Meyer et al. 2007, Welsch & Hodgson 2008). Even during brief periods of high water, fish enter those areas and gorge themselves on invertebrates made more available by the flooding. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct9
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	1	2	2			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Except when spawning, most anadromous fish spend much of their time in deep water because of the typically cooler temperatures and cover it provides. Preferred depths vary by species, season, and channel type. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth9
		<10 cm deep (but >0).	0	2	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish, and support higher productivity of invertebrates fed upon by fish. However, as aquatic plants decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov9
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers9
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Many studies have demonstrated that large woody debris is critically important to coho and steelhead. It provides cover and creates instream pools that help protect young fish from aerial predators. Shade from pools also provides cooler water preferred by salmonids. Removal of woody debris from one stream reduced salmonid use to one-fifth the levels with woody debris (Fausch & Northcote 1992). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove9
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Fish access to wetlands is better, and oxygen deficits harmful to fish are less frequent, if outflows from the wetland are persistent (Henning et al. 2006, 2007). Connectivity between tributaries and more permanent mainstem streams is essential to anadromous fish which use many off-channel habitats. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura9
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.33	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo9
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Atlantic salmon eggs and smolts are particularly sensitive to low pH (Rosseland et al. 2001, McCormick et al. 2012). *If pH is between 5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	Acid9
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver9
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Especially in riverine wetlands, groundwater (hyporheic flow) that discharges into wetlands is extremely important to salmonids because of its cooler temperature. However, in some instances this "iron floc" decreases the oxygen required by fish and smothers fish spawning gravels. Groundwater influx is sometimes indicated by an orange precipitate, indicating the presence of iron oxidizing bacteria (Dickman & Rygiel 1998).	GroundW9
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as contributing terrestrial insects (Wipfli 1997) and supporting richer and healthier aquatic invertebrate communities. All of these factors help support anadromous fish. Within 90 years after clear-cut logging without a 100-ft wide stream-side buffer, LWD could be reduced by 70% and recovery to prelogging levels would take more than 250 years. Also, establishment of conifer plantations can acidify receiving waters and potentially harm Atlantic salmon eggs (Kreutzweiser et al. 2008, Drinan et al. 2013, Malcolm et al. 2014). However, overall intensity of land use and forest fragmentation in a stream's watershed sometimes has a greater influence on stream fish abundance than does buffer width (e.g., Shandas & Alberti 2009, Stephenson & Morin 2009). The effects of buffer width or proportion of forest in the watershed can also be overshadowed by differences in stream substrate type and flow duration (Roy et al. 2005).	BuffPctNat9
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	In the Seattle area, salmon were dominant only in streams whose contributing areas contained less than 5% impervious surface. Salmon were essentially absent from streams draining areas with more than 35% impervious surfaces (May et al. 1997). Some types of watershed disturbances are probably more harmful to anadromous fish habitat than others. Impervious surfaces and storm drains, even when occurring at low densities but near drainageways that lead to the same stream or wetland, can dramatically alter the amount, timing, frequency, and duration of flow in streams and water level in lakes and wetlands (Booth et al. 2002, Konrad et al. 2005, Poff et al. 2006, Shields et al. 2008); increase pollutant loads and concentrations (Chadwick et al. 2006, Morgan et al. 2007); disrupt channel configurations (McBride & Booth 2005, Colosimo & Wilcock 2007); shift local air and water temperature regimes (Delgado et al. 2007); introduce chronic noise, predators, and other disturbances (Hepinstall et al. 2008); and as a consequence of these and related factors, alter the abundance, diversity, and species composition of fish and wildlife communities (Miltner et al. 2004, Hansen et al. 2005, Alberti et al. 2007, Walsh & Kunapo 2009, Cookson & Schorr 2009). *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	BuffLU9
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of fish are closely linked to specific thermal, olfactory, and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation timing (to which fish are not adapted) can reduce survival and ultimately populations. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime9
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0			0.56	High levels of contaminants (especially heavy metals such as copper) can be detrimental to anadromous fish.	ToxinIn9
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.42	Excessive sediment in spawning areas smothers fish eggs, limits aquatic productivity, contributes to surface water warming, and thus potentially adversely affects anadromous fish habitat (Kemp et al. 2011, Sear et al. 2008). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedIn9

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.25	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopCtr9
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd9
		<10 m.	1	5	5			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	1	1	1			
		>500 m.	0	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.67	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core9
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	0	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0				A direct indicator of value, at least for some species.	Fishing9
	Function Score for Feeding Waterbird Habitat					0.31	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., loons, grebes, cormorants, kingfisher) and mammals.	WbirdFeed

Hydro Regime	0.50	AVERAGE(Depth, SatPct, MAX(SeasWPct, PermWPct), Lake, Interspers, ThruFlo)	Hydropd9
Structure	0.28	AVERAGE[Beaver, AVERAGE(Wettype, WoodAbove, AqPlantCov, Shade, IsoWet)]	Struc9
Productivity	0.43	AVERAGE(GroundW, TidalProx, Elev, Wettype, Karst, Nfix)	Produc9
Landscape	0.61	AVERAGE(NatVegPctCU, BuffLU, ImpervCA)	Lscape9
Stressors	0.42	MIN(Acid, ToxicIn, SedIn, AltTime, ToxData)	Stress9

Function Score for Anadromous Fish Habitat	F	4.45	IF((Access=0),0,
			IF((AllSat1=0),0, ELSE:
			(AVERAGE(Access, OutDura)) X (AVERAGE(HydroRegime, Structure, Productivity, LScape, Stress))

Benefits Score for Anadromous Fish Habitat	V	4.45	AVERAGE(WbirdFeed, Fishing, Core, PopCtr, DistRd)

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Resident Fish Habitat	The capacity to support an abundance and diversity of native fish (both resident and visiting species) that are not anadromous or catadromous, e.g., Dolly Varden, cutthroat trout.	FR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Obviously, a wetland containing toxic substances has much less capacity to support anadromous fish. Resident fish are especially prone to bioaccumulation of locally-sourced metals (e.g., Deniseger et al. 1990).	ToxData10
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects and ultimately resident fish. Risk of winterkill by long-duration ice cover also may be less in warmer parts of the region.	Warmth10
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				1.00	Increased access to wetlands by anadromous fish can make other fish more vulnerable to competition or predation by anadromous fish. For non-anadromous fish, access to other water bodies is helpful to escape temporary oxygen deficits (particularly under ice in winter) and to access additional food and spawning areas, but is not always essential.	Access10
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	1	1	1			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Many fish and their supporting aquatic food webs are sensitive to water acidity. The effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Of the wetland types listed, riparian and marsh wetlands are typically most important because they have the most water and are the most accessible to resident fish. When accessible, other wetland types are used but invertebrate foods may be less abundant in those due to acidic conditions.	Wettype10
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	3	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005). From that, it can be inferred that fish production should be higher in alder wetlands as well, where food is limiting fish survival.	Nfix10
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	4	4			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Even if not connected to other water bodies, lakes are used extensively by resident fish, and lakeside wetlands provide shelter, rich feeding areas, and substrate for spawning by some species. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Lake10
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Used as a classifier. Wetlands that are never inundated cannot support resident fish.	SatPct10
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	2	2			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Persistent surface water is essential to resident fish in isolated wetlands, and is important to resident fish even in wetlands that connect seasonally to other water bodies. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct10
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Most resident fish spend much of their time in deeper water because of the cover it provides. Wetlands with deeper water provide more habitat space. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth10
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different resident fish species have different habitat needs, and a variety of depths within a wetland implies greater capacity of the wetland to meet the needs of multiple species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 10
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish and in some cases the associated shading helps maintain cool water temperature. However, as they decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct10
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides resident fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers10
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect young fish from aerial predators and provides cooler water preferred by salmonids. *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	WoodAbove 10
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				1.00	Fish access to wetlands is better if an outlet is present and outflows from the wetland are persistent. Although isolated wetlands with persistent surface water can support some resident fish, a permanent connection to other surface waters increases the ability of fish to move among wetlands and other surface waters in search of food and other needs. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura10
		Persistent (surface water flows out for >9 months/year).	1	3	3			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	2	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.33	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo10
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Fewer resident fish thrive in acidic (low pH) wetlands and ponds. However, as pond size increases and they begin to resemble lakes, pH often increases and consequently the ability to support a wider array of fish (Rempel & Colby 1991, Kimmel & Argent 2010, Sutela et al. 2010). *If pH is between 7.5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	AcidicPool10
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce more fish (Rempel & Colby 1991, Kimmel & Argent 2010) but levels greater than about 2000 mg/L TDS are usually harmful (Weber-Scannell & Duffy 2007). *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm or if plants indicate highly saline conditions. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other measurements are assigned a score of 0.5.*	Conduc10
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver10
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater provides relatively warm temperatures that can maintain ice-free conditions for longer, and helps sustain water levels and low flows, thus increasing annual production. However, the "flocs" created by the presence of iron oxidizing bacteria in some instances causes groundwater to be deficient in oxygen that is critical to resident fish, especially when this occurs under winter ice cover.	Groundw10
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as supporting richer and healthier communities of fish as well as invertebrates. Often, only very tolerant fish species are present in streams in heavily urbanized areas (Yoder et al. 1999) and invasive species may enjoy a competitive advantage over native species under urban conditions.	NatVegCU pct10
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of resident fish are closely synchronized to natural hydrologic patterns. Wetlands where that has been disrupted will have lower capacity to support resident fish. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime10
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.42	Excessive sediment limits aquatic productivity, contributes to surface water warming, and thus adversely affects resident fish habitat (e.g., Gray et al. 2005). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedExcess 10
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopDist10
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd10
		<10 m.	1	5	5			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	1	1	1			
		>500 m.	0	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.67	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core10
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	0	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0			0.00	A direct indicator of value, at least for some species.	Fishing10
	Function Score for Feeding Waterbird Habitat		3.07			0.31	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as birds (e.g., loons, grebes, cormorants, kingfisher).	WbirdFeed 10

Hydro Regime	0.35	AVERAGE(SatPct, Depth, DepthEven, PermWPct, Interspers, ThruFlo)	Hydro10
Structure	0.00	AVERAGE[Beaver, AVERAGE(Wettype, Shade, WoodAbove, ABpct, AqCov)]	Struc10
Productivity	0.33	AVERAGE(InletOutlet, GroundW, NewWetland, Wettype, Conduc, Karst, Nfix, Lake)	Produc10
Anoxia Risk	0.46	AVERAGE (OutDura, Depth, Warmth)	AnoxRisk10
Stressors	0.42	MIN(SedExcess, Acid, AltTime, ToxData, 1-NatVegCUpct)	Stress10

Function Score for Resident Fish Habitat	F	3.11	IF((Fish Access=0),0,
			IF((Water=0),0, ELSE:
			AVERAGE(HydroRegime, Structure, Productivity, AnoxiaRisk, Stress))

Benefits Score for Resident Fish Habitat	B	4.35	AVERAGE(Feeding Waterbird Habitat score, Fishing, PopDist, DistRd, Core)))

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Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	INV

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.40	Other factors being equal, wetlands closer to the coast tend to be more fertile due to deposition of airborne nutrients from marine waters. This potentially supports higher invertebrate numbers and perhaps diversity.	TidalProx8
		<100 m.	0	5	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.67	Macroinvertebrate and fish community composition is impacted beginning at about 5% impervious surface, a number that varies depending on the proportion of agricultural land as well (Waite et al. 2008). Comparing data from multiple regions, Utz et al. (2009) reported that aquatic invertebrates sensitive to impervious cover were generally lost when impervious cover was in the range of 3% (most sensitive taxa) to 23%.	ImpervCA
		<10%.	0	3	0			
		10 to 25%.	1	2	2			
		>25%.	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	warmth8
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to	0			0.00	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	karst8
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Many invertebrate groups (e.g., snails, isopods, lumbricid worms) cannot tolerate acidic conditions of bogs, and invertebrate richness generally tends to be greater in persistently inundated fens than in less persistently inundated marshes with more mineral soils (Holmquist et al. 2011). Marshes along lakes and rivers tend to have water longer into the growing season than other marshes and can support high abundance and diversity of invertebrates. One study reported that bogs and fens did not differ significantly with regard to invertebrate faunas. Dragonflies seemed to respond to the habitat's form and structure more than to its acidity or nutrient levels (Cannings & Cannings 1994)	Wettype8
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.33	Because different wetland types are likely to support different species assemblages and many of those species may require complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	Subtypes8
		A1.	0					
		A2.	1					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.83			0.83	On a per-surface-area basis, deciduous trees and shrubs often support higher levels of insect biomass than conifers, at least among nocturnal flying insects (Ober and Hayes 2008). *In calculations, is excluded automatically (cell goes blank) if few or no trees in the wetland. Score is based on the maximum cover of any of the 3 woody deciduous height classes, adjusted to the 0-1 scale.*	DecidTree8
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	Woody vegetation adds vertical habitat space, bark, and dead wood used by many invertebrates, whereas herbaceous vegetation has generally greater annual productivity. A well-interspersed even mix of both is hypothesized to maximize invertebrate diversity and productivity. In calculations, is excluded automatically (cell goes blank) if few or no trees or shrubs are present.	WoodHerb Mix8
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:				1.00	Downed wood provides food, cover, and a stable microclimate for many invertebrates that live in soil and peat of wetlands that seldom flood. In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation in the wetland. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown 8
		Few or none that meet these criteria.	1	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F9	N Fixers	Nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, other legumes) comprise:				1.00	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005).	Nfixers8
		<1% of the shrub cover and <1% of the ground cover, or trees are the only cover.	0	0	0			
		1-25% of the shrub cover (if shrubs/trees are the dominant cover) or 1-25% of the ground cover (if herbaceous plants are the dominant cover).	0	1	0			
		25-50% of the shrub cover (if shrubs/trees are the dominant cover) or 25-50% of the ground cover (if herbaceous plants are the dominant cover).	0	2	0			
		50-75% of the shrub cover (if shrubs/trees are the dominant cover) or 50-75% of the ground cover (if herbaceous plants are the dominant cover).	0	3	0			
		>75% of the shrub cover (if shrubs/trees are the dominant cover) or >75% % of the ground cover (if herbaceous plants are the dominant cover).	1	4	4			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	Vegetation provides more food and cover to invertebrates than do bare areas, so invertebrate density and diversity is typically greater.	Gcover8
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	3	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Greater microtopography implies greater heterogeneity of water, vegetation, and disturbance regimes, which together should indicate higher capacity to support a wide variety of invertebrates.	Girreg8
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:					The second condition implies greater diversity of plants, which sometimes is associated with greater diversity of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous vegetation in the wetland.*	HerbDiv8
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.50	The larvae of many wetland invertebrates require surface water, so the absence or scarcity of that limits aquatic invertebrate richness.	SatPct8
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Wetlands in which surface water persists longer are capable of supporting a wider variety of invertebrates, e.g., those that require many months or years to complete their life cycle, as well as those that mature more rapidly. Thus, wetlands with a proportionately large extent of persistent water may benefit a wide range of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct8
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	The parts of a wetland that are inundated only seasonally may contain water long enough for many invertebrates to complete their life cycle, while providing fresh food resources (e.g., plant litter). They also tend to be shallower and less deficient in dissolved oxygen, making them suitable for a wider range of species. Seasonal fluctuations release nutrients bound up in wetland sediments, and stimulate the growth of new plants whose seeds have been dormant. However, some invertebrate taxa, such as those without winged adult stages living in isolated wetlands (bog pools), may not survive prolonged desiccation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct8
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	1	2	2			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. Also, more stable water levels may benefit aquatic invertebrates in regions where many streams and wetlands are prone to sudden fluctuations from melting snow and storms. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc8
		<10 cm change (stable or nearly so).	0	3	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				1.00	Provided that they hold surface water for several weeks, shallow areas support greater primary production, support higher vascular plant densities, and consequently greater invertebrate production. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth8
		<10 cm deep (but >0).	0	3	0			
		10 - 50 cm deep.	1	5	5			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different invertebrate groups thrive at different water depths in boreal wetlands (Corcoran et al. 2009). Thus, a variety of depths may promote greater invertebrate richness for the wetland as a whole. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthDiv8
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.25	Many wetland invertebrates reach their greatest density in ponded areas. That is partly because the isolation protects them from predation by fish that normally inhabit the channels (Hornung & Foote 2006). Flowing water in channels favours different invertebrate assemblages, which when combined with the contribution of pools, adds to the overall diversity of the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet8
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	2	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Emergent and submerged vegetation typically hosts extensive growths of epiphytic algae, which along with the supporting herbaceous plants, provide food and cover for a wide variety of invertebrates. Intermediate cover conditions allow more light penetration of the water column, higher algal productivity, greater oxygenation, and thus tend to support a wide variety of invertebrate groups. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct8
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater invertebrate diversity overall may be supported by wetlands with a relatively even mix of open water and vegetation, interspersed throughout. Such conditions reflect a variety of light, temperature, and oxygen regimes as well as edge habitats (ecotones) that together provide more niches for invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers8
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					The importance of large wood to aquatic life has been widely documented in perennial streams (literature reviewed by Murphy 1995, May 2003, Wenger 2000, Knutson and Naef 1997) and in lakes (Roth et al. 2007). Many aquatic invertebrates attach to submerged wood and feed on algae and leaves associated with it. Constructed wetlands to which woody debris is added may support greater biomass or richness of several aquatic invertebrate groups (e.g., Alsfeld et al. 2009). Most instream wood originates in the parts of the riparian areas that are within 100 ft of a stream (McDade et al. 1990, Van Sickle & Gregory 1990, Robison & Beschta 1990, Meleason et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	AqCov8
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for invertebrates, so should result in greater species richness. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo8
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	1	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce greater biomass of aquatic invertebrates. *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other conditions are assigned a score of 0.5.*	Conduc8
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater provides a relatively steady input of nutrients (e.g., Morley et al. 2011). That can support greater algal production and consequently greater invertebrate production and perhaps diversity. It also provides relatively warm temperatures and helps sustain low flows, thus increasing annual production of invertebrates (Brown et al. 2007). However, where underlying geologic strata are iron-rich, groundwater discharge is often accompanied by precipitation of iron "floc" in wetland sediment, smothering aquatic invertebrates and reducing their diversity. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw8
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	Comparing data from multiple regions, Utz et al. (2009) reported that once urbanization in a watershed reached 60%, all taxa remaining responded either neutrally or positively with respect to continued urbanization. Most were harmed at much lower levels. The importance of streamside vegetation, especially trees, for sustaining the health of aquatic systems has been documented in the Pacific Northwest (e.g., Gregory et al. 1991, Naiman et al. 2000, Richardson et al. 2005, Wipfli et al. 2007). The positive effect is partly because wood falling into streams increases channel complexity which benefits aquatic invertebrates and fish; that may not apply to wood falling into wetlands. Trees also help maintain stream temperature and streams adjoined by natural vegetation support richer and healthier aquatic invertebrate communities (Richards et al. 1996). However, the effects of buffers and/or tree canopy closure on aquatic life in perennial streams vary, with some studies showing little effect on native fish (Roy et al. 2005, Fischer et al. 2010) and others a positive effect especially when buffer width was at least 100 ft (Frimpong et al. 2005, Horwitz et al. 2008). A 30-ft wide buffer along perennial streams in British Columbia was found to be insufficient to protect stream invertebrate communities from adverse effects of clear-cut logging, although the terrestrial insects the buffer provided were noted as a potentially important food source for fish using the streams (Hoover et al. 2007). Another study of BC perennial streams found uncut riparian buffers of at least 30 ft were needed to limit changes from clear-cut logging to aquatic life in headwater forested watersheds; those changes included increase abundance of aquatic invertebrates and algae (Kiffney et al. 2003). Increased sunlight from vegetation removal can increase stream and wetland productivity and thus the density of some invertebrate groups, where nutrients and elevation (stream temperature) are not severely limiting (Moldenke & Linden 2007).	NatVegPctC8
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Unvegetated uplands provide the least refuge for emerging aquatic insects, and also are most likely to contribute contaminants and disturb runoff patterns. Agricultural land cover seemed less impacting than impervious cover. Most organisms were capable of tolerating high levels of agricultural land cover, but a few disappeared when agricultural land cover exceeded 21% of the watershed area. *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	CUbuffLUtyp8
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	Life histories of most invertebrates are closely linked to specific thermal and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation to which invertebrate communities are not adapted may reduce populations of many intolerant invertebrate species and in some cases diminish local biodiversity (Bunn & Arthington 2002).	AltTime8a
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.58			0.42	Aquatic invertebrate communities (both benthic and planktonic) are harmed by excessive sedimentation and turbidity from sediment runoff. Sediment from timber-harvest activity (clearings and roads) can intensify the turbidity effects of spawning-salmon disturbance on macroinvertebrates. The deposition of fine sediment can limit populations of grazing invertebrates even when algal foods become more available following timber harvest (Kiffney & Bull 2000).	SedCA8a
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	Many wetland invertebrates inhabit the soil, and potentially are harmed by soil disturbance such as from tillage or compaction.	SoilDisturb8a
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
	Function Score for Anadromous Fish					0.45	Aquatic invertebrates are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as fish, bats, and birds (Baxter et al. 2005, Gende & Wilson 2001, Christie & Reimchen 2008).	
	Function Score for Resident Fish Habitat					0.31		
	Function Score for Amphibian Habitat					0.54		
	Function Score for Feeding Waterbird					0.31		
	Function Score for Nesting Waterbird					0.33		
	Function Score for Songbird, Raptor, & Mammal Habitat					0.74		

Structure	0.57	AVERAGE [ABpct, AVERAGE(AqCov, WoodHerbMix, HerbDiv, Gcover, WoodDown, Girreg)]	Structure8
Hydroperiod	0.56	AVERAGE [PermWpct, SatPct, SeasPct, Fluctu,GroundW)]	Hydropd8
Connectivity		AVERAGE(Interspers, ThruFlo, IsoWet)	Connec8
Productivity	0.64	AVERAGE [WetType, AVERAGE(Depth, Warmth, DecidTree, Hardwood, WoodDown, Nfixers, Conduc, TidalProx, Karst)]	Food8
Landscape	0.58	AVERAGE(Imperv, NatVegPctCU, CUbuffLUtype, Subtypes)	Lscape8
Stressors	0.61	AVERAGE(AltTime, SedCA, SoilDisturb)	Stressors8

Function Score for Aquatic Invertebrate Habitat	F	5.96	AVERAGE [Struc, Productivity, AVERAGE(Hydropd, Connec, Stressors, LScape]
Benefits Score for Aquatic Invertebrate Habitat	B	4.44	AVERAGE(AnadFish, ResFish, Amphib, WbirdF, WbirdNest, SongbMam)

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Amphibian & Turtle Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	AM

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.75	Larger contiguous tracts of nearby natural land, especially natural forest land, are more likely than small or fragmented patches to meet the habitat needs of dispersing and summering amphibians (Cushman 2006). Some New Brunswick data indicate tree plantations may be less suitable than natural forest for amphibians (Waldick et al. 1999), and clearcuts in Maine were found to be unsuitable even when logs and other coarse material was retained (Popescu et al. 2012).	NatVegSize11
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		100 to 1000 hectares.	1	6	6			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.29	Amphibians require upland habitat as well as aquatic habitat (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially natural forest within 1 km, usually provide the most suitable microclimates and habitat structure (Mazerolle et al. 2005, Baldwin et al. 2006a). Unvegetated or artificially vegetated areas, such as clearcuts and tree plantations (Waldick et al. 1999, Patrick et al. 2006), can inhibit movements of some species within upland habitats and reduce population viability. When radiotracked frogs on Vancouver Island were released inside clusters of trees amidst otherwise unsuitable habitat (clearcuts), the proportion of frogs abandoning the tree cluster was greater the smaller the cluster. Frogs were less likely to leave tree patches intersected by a running stream or where neighborhood stream density was high. Scattered tree patches of at least 1 ha, preferably in stream locations, were the minimum needed to allow normal overland passage of one frog species (Chan-McLeod & Moy 2007). The amount of forest surrounding a wetland is a strong positive predictor of amphibian richness and/or abundance (Findlay & Houlahan 1997), even more so than the amount of other surrounding wetlands (Quesnelle et al. 2015). However, on Prince Edward Island, no evidence was found to suggest that patch area or perimeter affects amphibian species richness (Silva et al. 2003).	NatVegProx11
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	7	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	1	2	2			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.60	See above.	NatCov2mi11
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	2	0			
		20 to 60% of the land.	1	3	3			
		60 to 90% of the land.	0	4	0			
		>90% of the land. SKIP to OF10.	0	5	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type of non-natural land cover that surrounds a wetland can influence dispersal success of amphibians. Unvegetated lands are usually the least suitable. Clearcuts may be better but perhaps still not as suitable as natural cover on soils of similar productivity (Waldick et al. 1999).	ScapeLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.71	Roads and/or traffic are a significant barrier to or hazard for dispersing amphibians, as demonstrated both in this region (Mazerolle 2004, Maxerolle & Desrochers 2005, Mazerolle et al. 2005, Jacobs & Houlahan 2011, Gravel et al. 2012) and elsewhere (Mader 1984, Fahrig et al. 1995, and see review by Fahrig & Rytwinski 2009). Roads with as few as 10 vehicles per hour can still have significant amphibian roadkill (Mazerolle 2004). Even some narrow logging roads that had long been abandoned continued to impair movements and densities of salamanders in North Carolina; the road effect appeared to extend about 35 m into the adjoining woods on both sides of the road (Semlitsch et al. 2007).	RdDis11
		<10 m.	1	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	1	5	5			
		>500 m.	0	7	0			
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	During certain times of their life cycle, frogs, turtles, and salamanders must move from their breeding wetlands into other wetlands or uplands with natural vegetation (Patrick et al. 2007, 2008). Pavement and other open surfaces act as barriers to these essential movements, and individuals that do attempt to cross roads are often crushed by vehicles (see above). In Ontario (Eigenbrod 2008a) and Virginia (Marsh 2007), "accessible habitat" -- defined as the habitat available to pond-dwelling amphibians without individuals needing to cross a major road -- was a better predictor of amphibian species richness than simply the amount of habitat within some distance of breeding ponds (Eigenbrod 2008b).	RoadCirc11
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.57	In this region, amphibians have been shown to occur more frequently in wetlands located close to other wetlands, or with a large number of other wetlands in close proximity (Stevens et al. 2002, Mazerolle et al. 2005, Jacobs & Houlahan 2011). That is because many species in these groups move regularly among wetlands in order to meet different life history needs (Gibbs 1993).	PondProx11
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					High levels of these substances, such as from livestock use or wastewater effluent, can harm amphibian populations and reduce amphibian diversity, e.g., Schmutzer et al. 2008). In calculations, the indicator score is set to 0 if those contaminants are present within the AA, is set to 0.2 if within 1 km and connected, is set to 1 if sampling shows no problems, or is set to blank (indicator is ignored) if data are insufficient.	Toxic11
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				1.00	Because amphibians and reptiles do not physiologically regulate their body temperatures and some are at the northern limit of their range in this region, it can be assumed that they may favour warmer microhabitats overall. Wetlands fed by water from south-facing slopes would be expected to be warmer, but the possible effect on amphibians has not been widely tested.	Aspect11
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	1	3	3			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	0	2	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Amphibians do not physiologically regulate their body temperature. Thus their populations are likely to be more productive (and have greater survival) in warmer parts of the region.	_GDD11
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Populations of some amphibians seem to thrive best in fishless wetlands. In some regions, predatory fish (especially, exotic species) severely reduce populations of native species (Pearl et al. 2005). *In calculations, if wetland is fishless it is scored as a 1 but if fish present this indicator is ignored in model calculations.*	FishAcc11
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	1	0	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	0	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	1	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			0.00	Areas of calcareous bedrock (karst landforms) tend to have more naturally-formed crevices and tunnels that could provide cover for amphibians during their terrestrial phases. Karst also tends to support higher aquatic productivity. *In calculations, the 0-3 category is first divided by 3.*	Karst11
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Marshes and fens are most likely to provide favored breeding habitat (e.g., Houlahan & Findlay 2003) andt many swamps contain important vernal breeding pools as well as providing excellent cover for dispersing adults. Some swamps in floodplains, however, have water levels that are too dynamic to support breeding by some amphibian speces.	Wettype11
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	2	2			
		B2. Not B1. Tree & tall shrubs comprise less than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.33	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of amphibian species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv11
		A1.	0					
		A2.	1					
		B1.	0					
		B2.	0					
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.19	During certain months of the year many salamanders and some frogs and toads require the moist microclimate and abundant invertebrate foods found in or under large downed wood in the uplands surrounding wetlands. Forests with large-diameter trees are most likely to have such conditions and in this region, American bullfrog and mink frog are more likely to occur in wetlands with nearby mature and overmature forest (Jacobs & Houlahan 2011). The dominant type of vegetation, both near a stream and in a watershed generally, also has the potential to strongly influence aquatic productivity (Ball et al. 2010) and thus tadpole survival, with deciduous vegetation usually indicating greater nutrient and light availability. However, one survey in this region found fewer amphibian species in wetlands surrounded by hardwood (deciduous) forest (Jacobs & Houlahan 2011). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeVar11
		coniferous, 1-9 cm diameter and >1 m tall.	0	1	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	2	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	3	0			
		coniferous, >40 cm diameter.	0	4	0			
		broad-leaved deciduous >40 cm diameter.	0	4	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	Interspersion of a balanced mix of concealing woody cover and warmer more food-rich openings of herbaceous vegetation probably provides optimal terrestrial habitat for most amphibians and turtles.	WoodHerbMix11
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:				1.00	Downed wood provides food, cover, and a stable microclimate for many salamanders (Patrick et al. 2006) as well as frogs and toads that move between wetlands (Freedman et al. 1996) but its presence may not be enough to offset broader changes in land cover (Popescu et al. 2012). *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown11
		Few or none that meet these criteria.	1	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	Although many amphibians may benefit from warmer temperatures associated with sparser ground cover within a wetland, dense ground cover provides better protection from predators (Mazerolle & Desrochers 2005). Thus, intermediate levels are scored highest.	Gcover11
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	2	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	3	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Complex microtopography provides many suitable microclimates important to survival of adult amphibians during the late summer, fall, and winter.	Girreg11
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					To meet all their life history requirements, most amphibians require uplands in close proximity to, or interspersed within, suitable wetlands.	Inclus11
		Few or none.	1	1	1			
		Intermediate (1 - 10% of vegetated part of the AA).	0	2	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	3	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.25	Although shade provided by wider buffers is beneficial to many aquatic species, populations of a few species of native frogs, pond-breeding salamanders, and aquatic invertebrates sometimes increase following partial removal of woody cover. Gaps in woody cover imply less shading and thus warmer water temperatures and algae, increasing aquatic productivity as long as sediment inputs do not increase greatly at the same time (Murphy et al. 1981, Hawkins et al. 1983). *In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation is present.*	ShrubSun11
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	1	1	1			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	3	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.50	Wetlands that contain at least a little surface water support breeding amphibians, but even those that lack surface water throughout the year may still provide dispersal sites for adult frogs, toads, and salamanders.	SatPct11
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	2	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.67	Surface water that persists for all or nearly all of the year provides reproductive as well as feeding and overwintering habitat for most amphibian species (Baldwin et al. 2006a). However, risk of fish predation may be greater in some persistently inundated wetlands if they are fish-accessible. Ideally, a wetland should exist as part of a mosaic of wetlands with different water regimes (Gibbs 1993). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct11
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.80	Egg masses of many frogs and aquatic salamanders are more susceptible to stranding in wetlands with large water level fluctuations. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu11
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Pools that remain isolated from other surface waters even during high water provide amphibians with the most protection from predatory fish. More amphibian species prefer ponded water than water flowing in channels. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet11
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The eggs and larvae of many frogs and aquatic salamanders can easily be harmed by excessive ultraviolet radiation. Aquatic plants may provide some degree of shelter from such radiation, as well as providing attachment surfaces for eggs. However, one survey found that, among wetlands in this region, amphibian richness increased with increasing open water area (Stevens et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct11
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Wider bands of wetland vegetation help protect a wetland's open waters from contaminants carried in from adjoining uplands. Wider bands of wetland vegetation also provide better cover for young frogs and salamanders as they transition to upland nonbreeding areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth11
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Unshaded open water areas potentially provide warmer conditions favoured by many amphibians, while nearby areas with cover provide protection from predators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers11
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect frogs and aquatic salamanders from aerial predators, and provides important basking sites. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove11
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Under many circumstances, a pH of less than about 4.5 inhibits reproduction and growth of most amphibians (Freda 1986). However, a survey of 159 Nova Scotia wetlands and ponds found green frog tadpoles in a wetland with pH 3.9, and six of 11 amphibian species were found in at least one wetland with a pH of less than 4.5 (Dale et al. 1985). Wood frogs appeared to be the most acid-tolerant, overall. *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acidic11
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands with substantial groundwater inputs tend to have more stable and reliable water levels, thus increasing the likelihood of amphibians breeding successfully. Also, winter water temperatures are warmer than most receiving surface waters. However, the cooler temperatures in summer associated with groundwater input may be less favourable to development of some amphibians. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx. Otherwise is rated based on response in column D.*	GroundW11
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.40	To meet all their life history requirements in this region, most amphibians require other wetlands and uplands in close proximity to, or interspersed within, suitable breeding wetlands (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially forest (Stevens et al. 2002), usually provide the most suitable microclimates and habitat structure. To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts et al 2005). Buffers narrower than 100 m will not protect most amphibian populations (Powell & Babbitt 2015).	NatVegPct11
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	This indicator is similar to the one above but focuses specifically on the type of unsuitable land cover closest to the wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Increased visitation by humans and pets can potentially increase the spread of aquatic fungi that are lethal to many amphibians.	Core1_11
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	0	5	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.50	See above.	Core2_11
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	2	0			
		5-50%.	1	1	1			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0			0.00	Excessive human traffic and free-roaming pets can harm native amphibians directly (collecting and predation) and indirectly (habitat alteration), so measures to reduce such impacts are given credit.	BMP11
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0			0.56	Amphibians are highly sensitive to many contaminants. These include road salt (Collins & Russell 2009), which is not necessarily diluted by spring rains to harmless levels (Karraker & Gibbs 2011).	ToxicIn11

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of amphibians on a wetland (and thus its importance) increases if no other natural vegetation of comparable type and extent is available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1		0	0.33	See above.	WoodyUniq
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of amphibians on a wetland (and thus its importance) increases if no other wetlands or ponds are in the vicinity.	DistPond10
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to amphibian biodiversity at a regional scale.	RareHerp
	Function Score for Feeding Waterbird Habitat					0.31	Amphibians are especially valued when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., herons) and mammals which prey upon them.	WBFscore10
	Function Score for Songbird, Raptor, & Mammal Habitat					0.74		SBMscore10

Hydro Regime	0.49	AVERAGE(Fluctu, SatPct, PermWpct, ISOwet)	Hydro11
Aquatic Structure		AVERAGE(ABpct, WoodAbove, Interspers, Vwidth)	AqStruc11
Terrestrial Structure	0.49	AVERAGE(WoodHerbMix, WoodDown, ShrubSun, Gcover, Girreg, Inclus, WetTypeDiv)	TerrStruc11
Productivity	0.33	AVERAGE(Aspect, GDD,TreeVar, GroundW, Karst)	Produc11
Landscape	0.34	AVERAGE[RoadCirc, AVERAGE(NatVegPct, BuffLU, NatVegProx, NatCov2mi, ScapeLU, NatVegSize)]	Lscape11
Waterscape	0.57	PondProx	Waterscape 11
Stressors (lack of)	0.53	AVERAGE(FishAcc, AVERAGE(RdDis, Toxic, Core1, Core2, BMP)	Stress11

Function Score for Amphibian Habitat	F	5.36	AVERAGE [(Wettype, Hydro, AVERAGE(AqStruc, TerrStruc, Produc, Lscape, Waterscape, Stress)]
Benefits Score for Amphibian Habitat	B	4.60	IF((RareHerp=1),1, ELSE: AVERAGE(WBFscore, MAX(HerbUniq, WoodyUniq, DistPond), SBMscore)

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Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	WBF

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.50	Larger wetlands are used disproportionately by feeding waterbirds. Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex.	AreaTotal12
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	4	4			
		1 to 10 hectares.	0	5	0			
		10 to 100 hectares.	0	6	0			
		>100 hectares.	0	8	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:					Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Although they will fly much farther than 1 km to reach other wetlands and water bodies (Haig et al. 1998), 1 km is used as a practical distance for identifying such features in aerial images.	PondProx12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:					Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is because they provide greater buffer against predators, are more likely to have productive fish populations, and are sufficiently long for waterbird species that cannot take flight by leaping directly upward.	BigPondProx12
		<100 m.	0	5	0			
		100 m - 1 km.	0	4	0			
		1 -2 km.	0	3	0			
		2-5 km.	1	2	2			
		5-10 km.	0	1	0			
		>10 km.	0	0	0			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.22	Wetlands with maritime climate are more likely to have conditions favourable to feeding and wintering waterbirds in this region. Many migratory waterbirds in the Maritimes follow a coastal route. Some non-tidal marshes (such as many dyked fields) that are within a few kilometers of tidal mudflats support large numbers of roosting migratory shorebirds.	TidalProx12
		<100 m.	0	9	0			
		100 m - 1 km.	0	7	0			
		1 - 5 km.	0	6	0			
		5-10 km.	0	4	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term. This indicator denotes potential or actual exposure.	_Tox12
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer mean annual temperature implies higher aquatic productivity and a longer period during which surface waters remain ice-free and thus usable by waterbirds.	Warmth12
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Especially during migration, the diversity of waterbirds may be greater in wetlands with fish because many wetland birds (e.g., loons, herons) feed extensively on fish. *In calculations, receives maximum indicator score if wetland has fish, but if fish absent, this indicator is ignored.*	Fish12a
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	1	1	1			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Most feeding waterbirds are naturally drawn to more productive wetlands, which tend to be marshes, especially those along rivers and lakes (Thormann & Bayley 1997, Epners et al. 2010). A lack of surface water in bogs and swamps makes them less suitable for most waterbirds.	Wettype12
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.33	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of feeding waterbird species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv12
		A1.	0					
		A2.	1					
		B1.	0					
		B2.	0					
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]				0.00	Mudflats and seasonally inundated shortgrass flats (including farmed wetlands, Taft & Haig 2005) are important to large numbers of migratory waterbirds.	Mudflat12
		None, or <100 sq. m.	1	0	0			
		100-1000 sq. m.	0	2	0			
		1000 – 10,000 sq. m.	0	3	0			
		>10,000 sq. m.	0	4	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.00	Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008).	EmPct12
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	1	0	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Fringe wetlands are often used by more wetland birds partly because the adjoining wide expanses of open water can provide refuge from disturbances as well as additional foods. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fringe12
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Larger water bodies such as lakes tend to attract higher densities of waterbirds, other factors being equal (e.g., Savard et al. 1994).	Lake12a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Although wetlands that never contain surface water may still be visited by feeding waterbirds, they are used by fewer species.	SatPct12
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	2	2			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.33	Surface water that persists for all or most of a year provides more feeding opportunities for wetland birds. If no surface water persists throughout a year, waterbird use of the wetland for feeding can still be substantial if the wetland borders a lake, large river, or estuary. Areas that are flooded only seasonally can be very productive when flooded. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct12
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.50	Wetlands that flood only seasonally tend to be more productive and are immensely important as feeding and resting areas for migratory waterbirds. Occasional severe flood or drought can rejuvenate wetland productivity, and thus waterbird feeding opportunities, by stimulating release of nutrients from sediments or soil. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct12
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	4	0			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	1	2	2			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Shallower water depths support greater aquatic productivity and thus are attractive to many feeding waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth12
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different waterbird species prefer feeding in different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of feeding birds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 12
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds feed more in ponded areas than along channels. Especially at times of high water in channels, off-channel ponded areas provide refuge for many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet12
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					For most waterbirds, intermediate proportions of open ponded water and vegetation appear to provide the best protection from predators and the elements, as well as the richest feeding opportunities (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct12
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	7	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Aquatic plant cover and the abundant invertebrates it supports are favored by many waterbird species. Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods, and waterbird use of such wetlands is usually significantly greater (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers12
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				These plants usually indicate highly enriched conditions, and those tend to be more productive feeding areas for most waterbird species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. In calculations, is counted as a positive if present but does not decrease score if absent.*	Algae12
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Food availability for most waterbird species in this region is greatest in wetlands whose pH is >7.5 (basic pH) and significantly less where pH is less than about 6.5 (Hanson & Calkins 1996). *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 7.5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acid12
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Beaver are a key driver for increasing and maintaining open water area throughout a region (Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver12
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope and riverine wetlands.	Gradient12
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core12a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	0	5	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.50	See above.	Core12b
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	2	0			
		5-50%.	1	1	1			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0			0.00	Frequent traffic by people and free-roaming pets can stress some waterbirds, so measures to reduce such impacts are given credit.	BMP12

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq12
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.25	If they attract waterbirds, wetlands closer to settled areas may also attract greater bird-centered use by humans (e.g., birdwatching, hunting) thus increasing their value.	PopCtr12
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare12
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Such areas have been chosen through a systematic selection process by biologists and birders in each state.	Ibird12v
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	Human enjoyment of waterbirds (birding, hunting) is facilitated where wetlands are largely visible from major access points. This increases the value of any level of feeding waterbird function.	Visib12
		<25%.	0	0	0			
		25-50%.	0	1	0			
		>50%.	1	2	2			
F64	Consumptive Uses (Provisioning Services)	Waterfowl hunting.	0			0.00	A direct (but hardly the only) indicator of value, at least for some species.	Duckhunt

Hydro Regime	0.37	AVERAGE(ISOwet, SatPct, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro12
Structure	0.25	AVERAGE[Interspers, AVERAGE(ABpct, EmPct), AreaTotal]	Struc12
Productivity	0.31	AVERAGE(Wettype, Acidity,Warmth, Fringe, Lake, Fish, Algae, TidalProx, Gradient)	Produc12
Landscape		IF((Fen+Marsh=0), blank, ELSE: AVERAGE(WetTypeDiv, Beaver, PondProx, BigPondProx)	Lscape12
Stressors (lack of)	0.30	AVERAGE(Corea, Coreb, BMP, _Tox)	Stress12

Function Score for Feeding Waterbird Habitat	F	3.07	IF((AllSat1=1),0,
			IF((TooSmall=1),0, IF((TooSteep=1), 0, ELSE:
			[AVERAGE(Lscape,Stressors, Produc) + 2*MAX(Mudflat, AVERAGE(Hydro, Struc)] /3

Benefits Score for Feeding Waterbird Habitat	B	4.17	IF((Rare=1),1, IF((IBirdv=1),1, MAX(HerbUniq, DistPond, AVERAGE(DuckHunt, PopCtr, Visib))))

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	Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	WBN					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.43	Larger wetlands in this region are used disproportionately by nesting waterbirds (Gibbs et al. 1991, Stevens et al. 2003). Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex. Larger areas also are preferred by many waterbird species as roosting or molting sites, because they provide greater buffer against predators. Larger wetlands also are more likely to have productive fish populations, and may be sufficiently long for some waterbird species (e.g., cormorants, loons) that require lengthy areas when taking flight.	SizeHerbac 13
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.63	Road corridors are often followed by ravens and mammals that prey on waterbird eggs and young, and fledglings are vulnerable to collisions with vehicles.	RdDis13
		<10 m.	1	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	1	5	5			
		>500 m.	0	8	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:					Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Corridors can be important to ducks that must walk overland with their young to find other wetlands in which to feed or molt. Nesting waterbird richness in this region is depressed more by isolation when that occurs in small than in large wetlands (Gibbs et al. 1991).	PondProx13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:					Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is partly because they provide greater buffer against predators, are more likely to have productive fish populations, and are long enough for waterbird species that cannot take flight by leaping directly upward (Stevens et al. 2003). Duckling survival is also greater in or near large ponded water bodies, provided they also have adequate cover. However, motorboat use is greater in some larger water bodies and the disturbance can affect waterbird breeding success.	LakeProx13
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 -2 km.	0	4	0			
		2-5 km.	1	3	0			
		5-10 km.	0	2	0			
		>10 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term.	Toxics13
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Breeding density of some waterbirds can be twice as great in fishless lakes than in lakes with fish, after accounting for lake area, and some species occur almost exclusively in fishless lakes due to greater abundance of aquatic invertebrates upon which they feed (Epners et al. 2010). *In calculations, receives maximum indicator score if wetland has water but is fishless, whereas if fish are present, this indicator is ignored.*	Fish13A
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	1	1	1			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	0	1	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	2	0			
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.					Although not applicable to all nesting waterbird species in this region, the models that predict suitable nesting habitat for black duck are likely to identify and map areas suitable for many. Black duck is a species that has declined in much of its historical range.	Bduck13
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.00	Waterbirds (e.g., black duck, Staicer et al. 1994) raise young most successfully in more productive wetlands, which tend to be marshes along rivers and lakes. However, many fens that contain ponded open water also are heavily used by some nesting waterbird species.	Wettype13
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.00	Large-diameter trees are more important because of their potential to provide rookeries for herons and nest cavities for a few waterbird species, e.g., hooded merganser. Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	TreeForm13
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	0	0			
		coniferous, 10-19 cm diameter.	0	0	0			
		broad-leaved deciduous 10-19 cm diameter.	0	0	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:				0.00	Snags provide nest cavities for a few waterbird species, e.g., wood duck, common goldeneye (Prince 1968). Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagB13
		None, or fewer than 8/ hectare which exceed this diameter.	1	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	3	0			
		Several (>8/hectare) but above not true.	0	2	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.00	Most waterbirds favor emergent herbaceous vegetation rather than woody vegetation, partly because it provides food as well as cover. Herbaceous rather than woody vegetation is the most attractive nesting cover for most species of waterbirds (Bolenbaugh et al. 2011), partly because it provides food as well as cover. Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008). Even tree-nesting species such as wood duck and goldeneye prefer nest sites with relatively open surroundings (Prince 1968).	EmPct13
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	1	0	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	0	5	0			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0			0.00	Open water is important to a wide array of nesting waterbirds, and is most available in "fringe" wetlands. *In calculations, is excluded automatically (cell goes blank) if wetland never has persistent surface water during an average year.*	Fringe13
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Lacustrine wetlands are especially attractive to nesting waterbirds, partly because of the variety of foods they provide, and the refuge that the large expanse of open water provides from terrestrial predators. However, use by some nesting waterbird species may be less if there is frequent motorboat use. In Maine, nesting waterbird richness was less in lacustrine wetlands than other wetland types, but the hosted species (loons, grebes) were less common in other wetland types so the lacustrine wetlands contributed disproportionately to regional bird diversity (Gibbs et al. 1991). *In calculations, presence increases the score but absence has no effect.*	Lacus13a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.40	Most waterbirds require some unflooded shoreline for nesting, while also needing large areas of water and emergent vegetation for feeding.	SatPct13
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	2	2			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	1	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.50	Surface water that persists for all or most of a year (and especially, during the early summer) provides more physical habitat for waterbirds. If no surface water persists, waterbird nesting can still be substantial if the wetland borders a lake, large river, or estuary. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct13
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.40	Most waterbirds situate their nests on or near persistent water. However, wetlands that flood only seasonally often provide more food and cover for young. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	4	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	5	0			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	1	2	2			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Large water level fluctuations during the nesting season (late spring and early summer), can flood the nests of birds that nest along wetland edges. However, annual fluctuations (described here) do not necessarily parallel propensity of water levels to fluctuate during the nesting season, and can stimulate wetland productivity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu13
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Most waterbirds prefer depths of 1- 2 ft. Wetlands with greater depths will nonetheless usually have some portion of their area in this and shallower depth classes. Even the shallowest areas are important to many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth13
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.50	Different waterbird species prefer different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 13
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	0	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	1	1	1			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds tend to feed more in ponded areas than along channels. If these isolated pools areas persist well into the summer, they allow waterbird populations to establish more breeding territories within the site, as well as concentrating invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry13
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Marshes with a relatively even mix of open water and emergent vegetation tend to support the most nesting waterbird species in this region (Gibbs et al. 1991, Longcore et al. 2006, Hierl et al. 2007). Emergent and submersed vegetation is an essential food for many duck species, either directly or because of the higher densities of invertebrate foods that it supports (Epners et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov 13
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	2	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Waterbird nests located in narrow wetlands may be more vulnerable to predation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs13
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	A gentle shore slope provides waterbirds with easier access to upland nesting cover near the water (Staicer et al. 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	ShoreSlope 13
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (Typha spp.), common reed (Phragmites), or tall (>1m) bulrush is:				0.00	Tall robust vegetation provides better nesting cover than does shorter vegetation.	EmRobust13
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1	0	0			
		1-25% of the emergent vegetation.	0	2	0			
		25-75% of the emergent vegetation.	0	4	0			
		>75%, of the emergent vegetation.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods (Longcore et al. 2006), and encourages establishment of breeding territories by more individual birds. Use of such wetlands has been shown to be significantly greater (Gibbs et al. 1991). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers13
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0				Waterfowl nests on Islands that are inaccessible to mammalian predators are more successful (Loekmoen & Woodward 1992). *In calculations, is excluded automatically (cell goes blank) if wetland lacks an island, but if island is present, it counts as a positive.*	Island13
F47	pH Measurement	The pH in most of the AA's surface water:					When non-acidic ponds are available, most duck species prefer to nest in those rather than acidic lakes and wetlands (Paquette & Ankney 1996, Epners et al. 2010), and nestling survival of at least one species is less in low-pH wetlands (McAuley & Longcore 1988). Fish-eating waterbirds in this region are most productive when nesting in non-acidic ponds (pH of 5.5 or greater, Parker et al. 1992), but in Maine sometimes nested in lakes that were more acidic (Gibbs et al. 1991). Some nesting waterbird species in Maine seemed unaffected by pond pH (Parker et al. 1992). *In calculations, the indicator score is set to 0 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	Acidic13
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	At least in the short term, open water areas created by beaver dams provide excellent nesting and foraging habitat for several waterbird species (Gabor et al. 2002, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver13
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope wetlands.	Gradient13
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	In herbaceous wetlands, the type of adjoining upland cover is very important to many nesting waterbird species. Most upland-nesting waterfowl nest within about 1000 ft of wetlands. Maintaining mostly non-woody but natural vegetation in such areas makes it difficult for predators to find nests.	BuffNatPct13
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	The type as well as the amount of upland cover near the wetland is important to nesting waterbirds. Impervious surfaces are unusable, whereas some low-intensity rural lands can provide marginally suitable cover. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUtype13
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core1_13
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	0	5	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.50	See above.	Core2_13
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	2	0			
		5-50%.	1	1	1			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0			0.00	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds, and human presence can attract crows and ravens, which prey on nests. Even the simple presence of people on foot and without dogs will cause many waterbirds to take flight. Repeated intrusions that drain the energy of waterbirds are especially damaging during the period when adult birds are searching for food to feed their young.	BMP13

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq13
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of nesting waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare13
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Wetland value is considered greater if it is part of an area recognised officially as being of outstanding importance to waterbirds. Such areas have been chosen through a systematic selection process by biologists and birders in this region and elsewhere.	_IBA13

HydroRegime	0.47	AVERAGE(ISOwet, SatPct, Fluctu, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro13
Structure		AVERAGE[(Interspers, AVERAGE(EmPct, EmRobust, SizeHerbac, Vwidth, AqPlantCov, Snags)]	Struc13
Productivity	0.38	AVERAGE(Wettype, Gradient, Acidity, ShoreSlope, Fish, Island)	Produc13
Waterscape		IF((Fen_ + Marsh=0), blank, ELSE: AVERAGE(Bduck, Lake, LakeProx, Fringe, Beaver, PondProx)]	Wscape
Stressors (lack of)	0.30	AVERAGE(Core1, Core2, BMP, Toxics)	Stressors13
Landscape	0.65	AVERAGE(BuffLUtype, BuffNatPct, RdDis)	Lscape13

Function Score for Nesting Waterbird Habitat	F	3.28	IF((AllSat=1), 0, IF((TooSteep=1),0, IF((TooSmall=1),0, ELSE: [3*AVERAGE(AqPlantCov, SizeHerbac, Wettype,Wscape) +2*AVERAGE(HydroRegime, Structure, Productivity) + AVERAGE(Stressors, Landscape)] / 6
Benefits Score for Nesting Waterbird Habitat	B	2.50	IF((Rare=1),1, IF((IBirdv=1),1, ELSE: MAX(DistPond, HerbUniq)

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Songbird, Raptor, & Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	SBM

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.43	Larger wetlands generally support more bird species than smaller ones (Findlay & Houlahan 1997) as well as being used disproportionately by some species. Smaller identical wetlands of equal cumulative area might support equal or greater cumulative richness of songbirds and mammals, especially if they are close together and connected with corridors of undeveloped land. For predicting bird diversity, some evidence from peatlands (Calme and Desrochers 2000) suggests that wetland size may be less important than microhabitat heterogeneity (which is represented by other indicators).	SizeHerbac 14
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.78	Many songbirds and mammals occur only in larger tracts of natural land cover. Fragmentation of wooded riparian areas by residential development or clearcuts can, over the long term, reduce the diversity of songbirds nesting in the remaining patches (e.g., Smith & Wachob 2006). Breeding wetland birds sometimes do persist in small disturbed wetlands as long as much larger undisturbed wetlands nearby remain productive (e.g., Vermaat et al. 2008). Ideally, no clearing should result in a forest being fragmented into an isolate smaller than about 40 ha or narrower than 50 m, and definitely not smaller than about 1 ha or narrower than 30 m (Donnelly & Marzluff 2004). In the Seattle metro area, Pacific (Winter) Wren occurred mostly in areas with less than 20% surrounding urban cover and forest patch size of more than about 1 ha (Donnelly 2004, Donnelly & Marzluff 2006). Theoretical and limited empirical data suggest that 30% or more forest cover across a large area is the threshold value above which landscapes might provide sufficient habitat and connectivity for many forest species, allowing those species' populations to survive even in small remaining patches (Andren 1994). Minimum patch sizes required for breeding by the most sensitive forest songbirds (e.g., Brown Creeper) may be about 10 ha (Donnelly & Marzluff 2004, Poulin et al. 2008). However, a study in British Columbia old growth forest found patch size had little to do with the abundance or diversity of birds in the forest (Schieck et al. 1995).	NatVegSize 14
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	6	0			
		100 to 1000 hectares.	1	7	7			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	9	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.29	Wetlands that are closer to natural land cover and not separated by roads that interfere with movements across the landscape, are more likely to support a large diversity of songbird and mammal species. Forest gaps deter red squirrel movement (Bakker & Van Vuren 2004) and hinder movements of many birds. Nests in wetland forest edges, where both jays and squirrels occur frequently, are depredated more often than those in wetland openings or forest interior, where predators were less common (Desanto & Wilson 2001). The probability that a forest-dwelling bird will fly in the open between two patches of forest decreases rapidly as the distance separating those patches increases (Desrochers & Hannon 1997, St. Clair et al. 1998). Forest bird species usually prefer to detour under forest cover even if the forested route is longer, but if the detour is too long, they will prefer a shortcut across openland. However, when possible most forest bird species avoid venturing farther than about 30 m from a forest edge (St. Clair et al. 1998)	NatVegProx 14
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	7	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	1	2	2			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.33	The total proportion of the land that is natural land cover, as well as its proximity, can affect songbird and mammal richness in wetlands. Wetlands that contain or are close to natural land cover, and not separated from that by roads that interfere with movements across the landscape, are more likely to support forest-dwelling species (Betts et al. 2007). In Ohio, migrant songbirds had the strongest positive correlation with natural land cover near streams when it was measured within ~250 m of streams, rather than in areas closer or farther. Some migrant songbirds were much less likely to occur where there were many buildings within that distance of streams (Pennington 2008). However, one study found that migrant bird abundance was statistically unrelated to either percent urbanised land or percent forest cover within 1 km.	NatVegPctScape14
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	4	0			
		>90% of the land. SKIP to OF10.	0	6	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type as well as the amount of disturbed upland cover near the wetland is important to mammals and nesting songbirds. For most species, impervious surfaces are unusable. Habitat gaps caused by placement of roads, driveways, or homes – as well as by natural features such as wide tidal channels -- can impact movements of mammals and birds (Trombulak & Frissell 2000, Ortega & Capen 2002). This is especially true when the gaps are wider than about 30 m (Rich et al. 1994, Rail et al. 1997, St. Clair et al. 1998, Belisle & Desrochers 2002, Tremblay & St. Clair 2010), and definitely when wider than 60 m (Creegan & Osborne 2005, Bosschieter & Goedhart 2005, Awade & Metzger 2008, Lees & Peres 2009). Species that prefer low vegetation may be particularly reluctant to cross forest clearings. The presence of small clusters of trees scattered within very wide forest gaps may be sufficient to enhance willingness of some forest bird species to cross those gaps (Robertson & Radford 2009).	ScapeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.63	High nest predation occurs on the edges of residential areas because jays and ravens are more abundant there. Nest predation can also be high in clearcut openings. Human settlements are accompanied by an increase in refuse, whether it be illegally dumped trash, recklessly contained household garbage, or well-intended compost piles. These serve as a food for ravens that prey extensively on native songbirds, frogs, and other wildlife (Chace & Walsh 2006). Crow populations have been shown to increase up to at least 1 km from new urban areas (Oneal & Rotenberry 2009).	PopCtr14
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	0	3	0			
		1 - 5 km.	1	5	5			
		>5 km.	0	8	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.75	Traffic poses a hazard to songbirds and mammals that attempt to cross roads (Forman et al. 2002, Clevenger et al. 2003, Massey et al. 2008, Minor & Urban 2010, Tremblay & St. Clair 2010, and see reviews by Fahrig & Rytwinski 2009, Benitez-Lopez et al. 2010). Roadsides also may channel the movements of predators. Noise from heavy traffic interferes with bird reproduction because some birds cannot hear singing of prospective mates (Wood & Yezerinac 2006, Slabbekoorn & Ripmeester 2008, Barber et al. 2010) and road noise can restrict habitat use by bats (Schaub et al. 2008) and moose (Snaith et al. 2002).	DisRd14
		<10 m.	1	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	1	6	6			
		>500 m.	0	8	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	Roads that completely encircle a wetland limit the access to the wetland by upland mammals, and may isolate small mammal populations within the wetlands. To sustain most forest-dwelling bird species, linear clearings should cause no gap in the forest canopy wider than about 30 m (Belisle & Desrochers 2002, Tremblay & St. Clair 2010). Roads also tend to concentrate nest predators.	RdBox 14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.57	Many wetland songbirds and mammals may prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can use alternate sites which may provide different but complementary types of food and cover. Corridors can be important to small mammals moving between wetlands.	PondProx 14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	1	4	4			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF16	Upland Edge Contact	Select one:				1.00	When wetland perimeter mostly adjoins upland rather than more wetland, this allows animals to move more conveniently between uplands and wetlands, benefitting from resources in each. In particular, small mammals avoid wetter (usually more central) parts of wetlands in favor of drier edges (Mazerolle et al. 2001).	UpEdge14
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1			1.00	Although hardly representative of the needs of all wetland-dependent songbirds and mammals, the presence of suitable wintering habitat for deer is an important component of this function. However, very high deer densities reduce habitat for ground- and understory-nesting birds.	DeerHab14
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.33	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of songbird and raptor species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv14
		A1.	0					
		A2.	1					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	1			0.17	Songbird richness within a site is strongly associated with a diversity of height classes, combined with a mix of conifer and deciduous trees/shrubs in each height class. Trees and shrubs support a wider diversity of songbirds, raptors, and mammals than does herbaceous vegetation, partly because they provide more vertical structure and produce downed wood and snags that have other habitat benefits. Trees help shelter the water in wetlands from high winds, facilitating the aerial foraging activities of birds and bats (Whitaker et al. 2000). *In calculations, the indicator score is based on number of height-form classes (of a possible 6).*	WoodyHtDiv14
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover. Then choose one:					Lack of one dominant shrub species suggests higher shrub richness, which has the potential to provide more food sources to more species throughout a season. *In calculations, is excluded automatically (cell goes blank) if wetland has <5% shrub cover. If second choice is marked this indicator is scored as a 1 but if first choice is marked this indicator is ignored in model calculations.*	ShrubDiv14
		those species together comprise > 50% of such cover.	1	1	1			
		those species together do not comprise > 50% of such cover.	0	2	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.25	Tree cavities needed by many nesting songbirds and mammals are found mostly in dead standing trees (snags) and larger-diameter trees. Larger-diameter stands also tend to be older and provide more structure useful to a variety of songbirds and mammals. Taller snags are especially useful to raptors as hunting perches. A mixture of tree species, especially mixtures that include aspen, is necessary to sustain populations of most boreal woodpecker species (Drever & Martin 2010). Deer need a diversity of forest types and ages (both early succession and old growth) near each other within their home ranges (Chang et al. 1995), as do moose (Snaith et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The indicator score is based equally on the proportion of classes present and their weighted average.*	TreeTypes 14
		coniferous, 1-9 cm diameter and >1 m tall.	0	1	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	3	3			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	4	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	Interspersion of woody cover with food-rich openings of herbaceous vegetation provides greater feeding opportunities for many songbirds and mammals, and is a natural phenomenon caused by windthrow and other factors in forested wetlands. In British Columbia, activity levels of bats were more than 40 times greater in riparian than in upland areas, due to greater abundance of emerging aquatic insects, and were significantly greater where stand complexity and extent of forest edges was greater. Gaps of 3-10 trees in an otherwise forested matrix, that comprise about 30% of the matrix, resemble most closely the conditions in mature forest of Vancouver island, BC (Lertzman et al. 1964). Most canopy gaps occupy 50-200 m2 and a diameter-height ratio is typically <0.50 (Ott & Juday 2002). Excessive gap frequencies and areas (i.e., forest fragmentation) and lack of corridors that connect forested wetlands with upland forests can be detrimental to some species if the remaining forested patches are very small. *In calculations, is excluded automatically (cell goes blank) if wetland has little or no woody cover.*	WoodPatt14
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:				0.50	Tree cavities are needed by many nesting songbirds (Drapeau et al. 2009) and mammals such as roosting bats (Grindal & Brigham 1999, Grindal et al. 1999). Tall snags are especially useful to raptors as hunting perches. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagsD14
		None, or fewer than 8/ hectare which exceed this diameter.	1	1	1			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	2	0			
		Several (>8/hectare) but above not true.	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:				1.00	Downed wood provides cover for many small mammals. Downed wood is often the result of natural windthrow, which also creates small patches of semi-open canopy within blocks of forest and in so doing can support a larger number of wildlife species, despite the temporary loss of nest trees (Zmihorski 2010). In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown 14
		Few or none that meet these criteria.	1	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Due to fertilizing effects of its nitrogen-fixing capacity, alder can increase the abundance of forbs important to songbirds and other wildlife.	Nfix 14
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	4	4			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.20	Although scattered open spots provide feeding opportunities for some species, most ground-nesting songbirds and mammals prefer dense ground cover as concealment from predators. Thinning of ground cover by high densities of deer can impact songbirds (Thiemann et al. 2009, Martin et al. 2010).	Gcover14
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	5	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Complex microtopography reflects and provides more extensive habitat for small mammals and some songbirds.	Girreg14
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					Wetlands with upland inclusions allow animals to move more conveniently between uplands and wetlands, using resources in each.	Inclus14
		Few or none.	1	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	0	1	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.67	Most songbirds prefer to nest in drier parts of wetlands because ground cover and vegetation height, which provide essential structure, tend to be greater there.	SatPct14
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	4	4			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	6	0			
		99-100% . AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				1.00	Parts of wetlands that remain flooded most of the time will support fewer small mammals and songbirds due to lack of vertical structural complexity. Wetlands with at least a little persistent water are important to aerially-foraging swallows, swifts, and flycatchers, as well as bats, muskrat, beaver, moose, and many other mammals. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct14
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	3	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Wider vegetated zones within wetlands provide more nesting space and structure for songbirds and mammals. Wider riparian buffers in British Columbia supported a greater density of deciduous trees important to wildlife diversity in that region (Shirley 2004). Also in British Columbia, even buffers of 150 m failed to support several species at densities equivalent to those in extensive uncut forests: Brown Creeper, Pileated Woodpecker, Golden-crowned Kinglet. However, at least 2 species -- Warbling Vireo and Swainson's Thrush – were more common in buffers than in uncut forest (Shirley & Smith 2005). The diversity of microhabitats within bogs and fens generally increases with increasing area, and vertebrate richness consequently increases (Desrochers & van Duinen 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth14
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					When water and vegetation (especially woody or other robust vegetation) are moderately interspersed, this provides more extensive feeding areas for many wetland-dependent songbirds and raptors. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers14
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Beaver impoundments, especially after they are abandoned and revert to early successional shrubs, support higher bird species richness than many other land cover types (Grover & Baldassarre 1995, Aznar & Desrochers 2008) and are also important to river otter (LeBlanc et al. 2007, Gallant et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver14
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.20	To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts & Forbes 2005). However, riparian buffer strips 50 m wide were insufficient to maintain nesting forest interior songbird species in Newfoundland (Whitaker & Montevecchi 1999).	BuffPerim14
		<5% .	0	0	0			
		5 to 30% .	1	1	1			
		30 to 60% .	0	2	0			
		60 to 90% .	0	4	0			
		>90% , or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Small mammals moving between wetlands are less likely to have their movements disrupted by lands with residual cover than in lands with impervious surface, but both are capable of hindering dispersal (Flaherty et al. 2008). *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	CUtypeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Some of these features are important to bank-living beavers, swallows, and swifts. *If present this indicator is scored as a 1 but if absent this indicator is ignored in model calculations.*	Cliffs14
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Human presence can attract crows and ravens which prey on nests. Dogs and house cats that prey on wetland songbirds and mammals also tend to be more prevalent in areas frequently visited by humans.	Core14a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95% , with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	0	5	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.67	See above.	Core14b
		<5% . If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	3	0			
		5-50% .	1	2	2			
		50-95% .	0	1	0			
		>95% of the AA.	0	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of songbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq14
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of songbirds on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq 14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of wetland-associated songbirds, raptors, and mammals on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	0	1	0			
		50-500 m, but separated by those features.	1	1	1			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1			1.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to songbird biodiversity at a regional scale. In New Brunswick, wetlands are used to a greater extent than other habitats by the bird species identified as being of highest conservation concern (Environment Canada 2013).	Rare14
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	These areas were designated based on a rigorous nomination and screening process by ornithologists.	_IBA14

StructureA	0.74	AVERAGE (Gcover, Girreg, Cliffs, SnagsD, WoodDown, DeerHab)	StrucA
StructureB	0.14	AVERAGE (WoodyHtDiv, ShrubDiv, WoodPatt, TreeTypes)	StrucB
Productivity	0.38	(AVERAGE(SizeHerbac, Vwidth))*((AVERAGE(Nfix , Inclus, UpEdge, Hardwd)))	Produc
Landscape	0.56	AVERAGE (WetTypeDiv, CUbuffNatPct, CUtypeLU, NatVegProx , NatVegPctScape, ScapeLU, NatVegSize)	Lscape14
Waterscape	0.56	AVERAGE (SatPct, PermWpct, PondProx , Beaver, Interspers)	Wscape14
Stressors (Lack of)	0.49	AVERAGE (CoreA, CoreB, BuffPerim, PopCtr, RdBox , DisRd)	Stress14

Function Score for Songbird, Raptor, & Mammal Habitat	F	7.39	IF((AllWater=1),0, ELSE: (AVERAGE(PermWpct, AVERAGE(StrucA, StrucB, Produc, Lscape, Wscape, Stress))
Benefits Score for Songbird, Raptor, & Mammal Habitat	B	10.00	IF((Rare=1),1, IF((IBA=1),1, ELSE: MAX(HerbUniq, WoodyUniq, DistPond)

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Pollinator Habitat	The capacity to support a diversity or abundance of pollinating insects, such as bees, wasps, flies, butterflies, moths, and beetles.	POL

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.17	Native pollinators are most abundant and diverse where naturally vegetated areas are nearby. Distance to such areas is often a strong predictor (Westphal et al. 2006, Ricketts et al. 2008, Garibaldi et al. 2011). However, the minimum size of such patches that is capable of influencing pollinators is unknown.	DistNat0
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	6	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	1	1	1			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.50	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded by a large proportion of unmanaged vegetation (Savage et al. 2011, Kennedy et al. 2013, Moisan-Deserres et al. 2014b, Cutler et al. 2015).	CovPct Scape0
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	3	0			
		>90% of the land. SKIP to OF10.	0	4	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				0.80	Among woody plants, low shrubs such as blueberry and current tend to be the most common sources of pollen for pollinating insects, and are most dependent on insects for pollination. *In calculations, the woody plant height and form that is most favoured by pollinators (column E) and is most predominant (column D) is identified automatically and placed on the 0 to 1 scale.*	WoodyHt Form0
		coniferous trees (may include tamarack) taller than 3 m.	0	0	0	20		
		deciduous trees taller than 3 m.	0	1	0			
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	0	3	0			
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	5	4	20			
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1	5	5			
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1	5	5			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					A wider variety of woody plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	ShrubDiv0
		those species together comprise > 50% of such cover.	1	1	1			
		those species together do not comprise > 50% of such cover.	0	0	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.13	A mix of diameter classes may indicate a wider variety of woody species available for pollination. The formula gives equal weight to the variety of classes and increasing mean diameter. Deciduous trees allow more light penetration and thus tend to support more flowering plants in the understory. Larger trees provide more deadwood for bee and wasp colonies. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The score is based equally on the proportion of classes present and their weighted average.*	woodydbh0
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	1	1			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	3	0			
		coniferous, 20-40 cm diameter.	0	4	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:				0.00	Dead wood provides critical nesting habitat for many pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	Sngs0
		None, or fewer than 8/ hectare which exceed this diameter.	1	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	1	0			
		Several (>8/hectare) but above not true.	0	1	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:				0.00	Downed wood provides nest sites and shelter for some pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	downwood0
		Few or none that meet these criteria.	1	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	A small proportion of bare earth is important to some burrowing pollinators, but too much is at the expense of plants that provide pollen (Moisan-Deserres et al. 2014a).	gcover0
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	1	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	3	3			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Many pollinating species depend on such microtopographic features for nest sites and cover.	girreg0
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:					Flowers from forbs provide the most opportunities for a diverse array of pollinator species, but some graminoids (e.g., native bunchgrasses) are used as well.	Forbs0
		<5% of the herbaceous part of the AA.	0	0	0			
		5-25% of the herbaceous part of the AA.	0	1	0			
		25-50% of the herbaceous part of the AA.	0	2	0			
		50-95% of the herbaceous part of the AA.	0	3	0			
		>95% of the herbaceous part of the AA.	0	4	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:					A wider variety of herbaceous plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	herbdiv0
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				0.75	Although some non-native plants attract pollinators, many of those plants tend to be invasive, reducing the overall diversity of plant species available for pollination at different times of the season (Thijs et al. 2012). A broad seasonal distribution of available pollen and nectar sources is critical to maintaining pollinator diversity.	herbsens0
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	0	4	0			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	1	3	3			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Wetlands comprised almost entirely of persistent water usually have much less vegetation cover, so fewer plants per unit area are available to pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	persist0
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded at least partially by, or close to, unmanaged vegetation (Moisan-Deserres et al. 2014b, Cutler et al. 2015).	BuffPerim0
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	3	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	3	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.00	See above. *In calculations, is ignored if >90% of the wetland perimeter has a vegetated buffer. In other situations, the indicator score is set to 0 if impervious but otherwise is ignored in the model calculations.*	BuffLUtype0
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Rocky and other bare areas are more likely to support burrows for pollinator nests and mud for hive construction (Moisan-Deserres et al. 2014a).	cliff0
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.44			0.56	Many pollinators are highly sensitive to some of the pesticides used in this region (e.g., Kevan 1975, Plowright & Rodd 1980, Brittain et al. 2010, Gradish et al. 2012).	Toxic0
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of pollinators on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq0
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of pollinators on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq0
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	1			1.00	Pollinators may be especially valuable if the wetland contains a rare plant species dependent on insect pollination (Jones & Klemetti 2012).	RareHerb

Pollen Onsite	0.84	AVERAGE[MAX(WoodyHtForm, Forbs), AVERAGE(herbsens, herbdiv, ShrubDiv)]	PollenOn
NestSites	0.61	AVERAGE[persist, AVERAGE(woodydbh, snags, downwood, girreg, cliff, gcover)]	NestSites
Stressors (lack of)	0.38	AVERAGE(Toxic, CovPctScape, DistNat, BuffPerim, BuffLUtype)	Stress0

Function Score for Pollinator Habitat	F	6.09	IF(AllWet=1), 0, AVERAGE(PollenOnsite, NestSites, Stress)
Benefits Score for Pollinator Habitat	B	10.00	MAX(HerbUniq, WoodyUniq, RareHerb)

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Native Plant Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	PH

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.29	Larger wetlands generally support more plant species than smaller ones (Weiher & Boylen 1994, Findlay & Houlahan 1997, Matthews 2004, Houlahan et al. 2006) although in some landscapes, smaller identical wetlands of equal cumulative area support equal or greater cumulative richness of plants (Peintinger et al. 2003).	SizePD
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	1	2	2			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.75	Although urbanization typically reduces the diversity of plants in the forest understory, plant community composition in a Wisconsin study was better explained by the amount of surrounding forest than by environmental factors within the studied forests (Rogers et al. 2009). A leveling off of the plant species-area accumulation curve in Alberta forests appeared at a forest patch size of about 10 ha (Gignac & Dale 2007). A study in Washington found that forest patches as small as 1 ha, if not narrow, may be large enough to have a microclimate supportive of most plants and animals (Heithecker & Halperin 2007). Depending on their shape, forest patches sised about 4 ha or larger may provide habitat capable of sustaining a diverse array of bryophyte functional groups in temperate rainforest landscapes (Baldwin & Bradfield 2007).	SizeVeg Connec15
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	5	0			
		100 to 1000 hectares.	1	6	6			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.17	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006).	DistBig15
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	6	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	1	1	1			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.50	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006). However, one study found that forested wetlands in developed landscapes had community composition and structure similar to those in undeveloped landscapes, with number of exotic species being no greater (Ehrenfeld 2005)	VegPct5k15
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	1	2	2			
		60 to 90% of the land.	0	3	0			
		>90% of the land. SKIP to OF10.	0	4	0			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.67	Non-native plants that can reduce native plant richness tend to be more prevalent closer to population centers because many have been introduced intentionally or unintentionally by humans.	PopCtr15
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	0	3	0			
		1 - 5 km.	1	4	4			
		>5 km.	0	6	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.83	Road corridors are a significant vector for non-native plants that can reduce native plant richness if they invade nearby wetlands.	DistRdPD
		<10 m.	1	0	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	5	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	1	5	5			
		>500 m.	0	6	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.50	Wetlands that are more geographically isolated from each other may be likely to have lower plant species richness than those close together (Nekola 1999).	PondProx15
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	1	3	3			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Wetlands, especially bogs, that are ice-free for longer during the year, as inferred from growing degree days, tend to have more plant species (Glaser 1992).	GDDpd
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			1.00	Many species which contribute disproportionately to regional biodiversity due to their rarity occur in areas of limestone (calcareous) bedrock and soils, and not where exposure to acid precipitation is great. This indicator is ignored in calculations unless calcareous soils or bedrock are present or site is in a region where exposure to acid precipitation is relatively limited.	Karst16a
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	1			0.17	Plant species richness within a site may be broadly associated with a diversity of height classes, especially if combined with a mix of conifer and deciduous trees/shrubs in each height class (Brandt et al. 2015). *Score is based on number of height-form classes (of a possible 6) that are present.*	WoodyHtDiv 15

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F3A	Deciduous Woody Cover		5			0.83	Deciduous cover allows more light to penetrate to the ground than does evergreen cover. In many instances this results in greater richness of understory plant species. *In calculations, is excluded automatically (cell goes blank) if few or no trees are present. Score is based on maximum deciduous cover in either the shrub (1-3 m) or tree (>3 m) categories.*	DecidCov15
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:				0.00	A dominance of common species usually implies overall reduction in plant species richness. Although shrubs contribute to onsite plant diversity, wetland shrub communities are generally less diverse than herbaceous plant communities in wetlands. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodSp Dom15
		those species together comprise > 50% of such cover.	1	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	Wetland plant species richness often correlates positively with presence of a relatively even and dispersed mix of herbaceous and woody vegetation within the wetland (Brandt et al. 2015). Sparse woody cover sometimes indicates overgrazing by deer, which reduces plant diversity (Thiemann et al. 2009, Martin et al. 2010). *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	WoodHerb Mix15
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.33	Red alder often occurs in mildly disturbed settings, and through its ability to increase soil fertility by fixing nitrogen, can increase the cover and perhaps the diversity of understory plants. However, as alder stands age, they form a closed canopy which can block light and reduce understory plant richness.	NfixPD
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Different plant species occur under different moisture regimes, which correlate with different elevations (Samoni et al. 2010), so a greater diversity of elevations (i.e., complex microtopography) often supports a wider variety of plants. Adding small ridges and furrows to constructed depressional wetlands was found in one study to increase their percent cover of obligate wetland species (Alsfeld et al. 2009). Wetlands with more varied topography tended to have greater plant species richness because this creates different flood frequencies within the wetland (Pollack et al. 1998).	GirregPD
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.50	Coarse soils tend to be less productive and in some cases this results in reduced species richness of wetland plants. Wetland soils with higher organic content often support greater plant species richness (e.g., Alsfeld et al. 2009).	SoilTexPD
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	0	2	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:					Wetlands not dominated by one or two plant species are generally more diverse (e.g., Houlahan & Findlay 2004). *In calculations, is excluded automatically (cell goes blank) if little or no exposed herbaceous cover is present.*	herbdom15
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				0.75	Invasion by non-native species often reduces native plant species richness (Zedler & Kercher 2004, Schooler et al. 2006) but not always (Houlahan & Findlay 2004). In some regions, a change of only 10 cm in mean water level or a change of only 2 cm in the degree of fluctuation may cause a shift from native to non-native species (Magee & Kentula 2005).	Invas15
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	0	4	0			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	1	3	3			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			InvasDom1
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				0.75	Although not all invasive upland plants are capable of establishing sustained populations in wetlands, many can. When they do they reduce plant diversity.	WeedSourcePD
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	0	4	0			
		some (but <5%) of the upland edge.	1	3	3			
		5-50% of the upland edge.	0	2	0			
		most (>50%) of the upland edge.	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				1.00	More plant species occur in drier parts of wetlands than in parts that remain flooded for long duration. However, long duration flooding adds some aquatic species not otherwise found in wetlands.	SatPct15
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	1	4	4			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	3	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.75	In many regions, wetlands with extensive seasonal flooding tend to have greater plant species richness (Pollack et al. 1998). Seasonal inundation brings in external nutrients to riverine wetlands, and in all wetlands is necessary for seed germination of many wetland plant species. For determining the number of plants and number of species that germinate, the monthly timing of first soil moistening may be more important than the duration of the pre-inundation moist period or the length of inundation (Bliss & Zedler 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpctPD
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	0	1	0			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	1	3	3			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Wetlands with naturally fluctuating water levels tend to have greater plant species richness, at least in Southeast Alaska floodplains (Pollack et al. 1998). Duration, frequency, and timing of inundation may be more important than magnitude of fluctuation, but cannot be estimated during a single visit to an ungaged wetland. Prolonged deep flooding can reduce plant species richness (Bayley & Guimond 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	FlucPD
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	2	0			
		>2 m change.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	With regard to submersed aquatic plants, shallower areas generally have greater plant richness due to greater availability of light and sediment oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth15
		<10 cm deep (but >0).	0	6	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Wetlands with wider vegetated areas are more likely to contain more plant species and rarer and more sensitive plants, as well as being more insulated from some upland disturbances (Rooney & Bayley 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthPD
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	1	2	2			
		30 - 49 m.	0	3	0			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Relatively even mixes of emergent plants and open water imply that both submerged aquatics and emergents may be present, thus comprising greater diversity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	IntersperPD
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Inflowing streams bring plant propagules that can sprout and diversify wetland plant communities. Wetlands with surface water connections also tend to be more fertile, although suspended silt can reduce submerged aquatic plants.	InflowPD
F47	pH Measurement	The pH in most of the AA's surface water:					Acidity (pH) influences the species composition, diversity, and productivity of plants within this region's wetlands (Catling et al. 1986, Mullen et al. 2000). Although acidic wetlands tend to be less fertile, they often are the most diverse (e.g., Woodcock et al. 2005). Especially when located near the coast, they often contain plant species that are regionally rare because they cannot withstand the competition present in less acidic, more fertile wetlands that occur more widely (Moore et al. 1989). However, acidic lakes that are naturally stained by tannins ("brownwater lakes") have fewer submersed aquatic plant species because the stained water reduces underwater light (Kerekes & Freedman 1989). *If pH is <5.5, the indicator score is set to 1. Otherwise, this indicator is ignored in calculations.*	Acidic20
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Nutrients, as represented indirectly by conductivity and/or TDS, directly influence the species composition (Srivastava et al. 1995), diversity, and productivity of plants within this region's wetlands, perhaps to a greater degree than acidity. In nearby regions, plant species richness in wetland quadrats declined with increasing nitrate and phosphorus (Houlahan et al. 2006), especially when conductivity exceeded ~400 µS/cm (Johnson & Leopold 1994). *In calculations, the score is set to 1 if TDS exceeds 220 mg/L or conductivity exceeds 400 uS/cm). In calculations, indicator is ignored if any other condition exists.*	Conduc20
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Beaver impoundments increase richness of wetland plants locally, especially a few years after they are abandoned (Pollock et al. 1998, Wright et al. 2002, 2003; Gallant et al. 2004, Bayley & Guimond 2008, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	BeaverPD
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Partly because of the greater nutrient levels and relative hydrologic stability of most groundwater (Langlois et al. 2015), several plant species thrive best where a wetland's surface water originates most directly from groundwater (e.g., Radies et al. 2009). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	GWpd
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	Lichens and mosses have been affected by edge-induced microclimate changes extending at least 50 ft into forested areas (Hylander et al. 2002, Boudreault et al. 2008) and as far as ~150 ft from the forest edge (Baldwin & Bradfield 2005). In Oregon, selective thinning of forests that adjoined riparian buffers did not affect the herbaceous or shrub cover in the buffers when they were wider than ~50 ft (Anderson & Meleason 2009). Thinning can increase the distance seeds disperse into the forest and the number that disperse successfully (Cadenasso et al. 2001). One study found that where more than 50% of the basal area was cut, a significantly different plant community structure resulted. Partial cutting did not significantly change abundance for most of the important forage species for deer.	NatVegCApd
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Some types of surrounding land cover are more likely to produce propagules of invasive plants that may reduce native plant richness in an adjoining wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUpd
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F57	Burn History	More than 1% of the AA's previously vegetated area:					At least in herbaceous wetlands, infrequent moderate-intensity fires diversify the herbaceous plant community, partly by releasing nutrients bound in soils and vegetation, and reducing shade and competition (e.g., de Szalay & Resh 1997).	Burn20
		Burned within past 5 years.	0	4	0			
		Burned 6-10 years ago.	0	3	0			
		Burned 11-30 years ago.	0	2	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Seeds of non-native plants commonly are carried by humans and their pets. Non-native plants can decrease plant species richness of the wetland. In the Kenai Peninsula of Alaska,significantly fewer nonnative species were found beyond a 500-m distance from a trailhead. High-use trails, especially those in open-canopied areas, exhibited the greatest numbers of nonnative species at the farthest distances from the trailhead and contained a greater number of less common nonnative species.	Core1pd
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	1	2	2			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	0	5	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.67	See above.	Core2pd
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	3	0			
		5-50%.	1	2	2			
		50-95%.	0	1	0			
		>95% of the AA.	0	0	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0			0.00	Trampling of native vegetation by recreationists can decrease seed germination and increase vulnerability to invasion by more tolerant invasive plants and ultimately reduce native plant richness. These and other Best Management Practices (BMPs) potentially reduce such damage.	BMPsoils20
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0				Calcareous fens often support more plant species than other wetlands of similar size, and the species they support are usually among the regionally rarest (Hinds 1983, Hill & Keddy 1992, Mullen et al. 2000, Hinds 2000, McClellan et al. 2003).	CalcFen15
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	The germination of many plant species is triggered by the interaction of water conditions and season (light). Homogenization or alteration of the natural water regime can thus encourage invasive species at the expense of native flora (Zedler & Kercher 2004, Catford et al. 2011). Inundation at aberrant times of the year can reduce native plant diversity because most native species have evolved in close synchronization with natural seasonal water regimes. Any development that involves increasing the area of lawn or impervious surface is likely to increase runoff amount and concentrate it within shorter time periods, i.e. "pulses" "flashiness" (Booth & Jackson 1997, Booth et al. 2002, DeGasperi et al. 2009). This makes wetlands more susceptible to invasion by non-native plants (Magee & Kentula 2005). *In calculations, is excluded automatically (cell goes blank) if wetland has no surface water inflow.*	AltTime20
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.44			0.56	Increased dominance by fewer species, such as cattail and various invasive plants, often results from increased salinity in normally non-saline wetlands, and results in decreased native plant richness (Gleason & Euliss 1998).	Salt20
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.58			0.42	Deposition of only 0.25 to 0.5 centimeter of new sediment has been shown to significantly reduce species richness, emergence, and germination of wetland plants (Gleason et al. 2001),	SedDep20
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	Even if vegetation is not removed, compaction of winter snow cover can damage vegetation (Keddy et al. 1979), and compaction of soil can inhibit plant growth by decreasing soil oxygen and altering drainage patterns. Soil disturbance also facilitates invasion by exotic species, and sedimentation limits the germination and growth of wetland plants (Wardrop & Brooks 1998, Mahaney et al. 2005).	SedDisturb20
#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationale	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	0			0.00	Dependency of herbaceous plant species on wetlands increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq20
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	1			0.33	Dependency of woody plant species on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq20
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	1			1.00	These wetland species are particularly valued because of their rarity and/or declining populations as listed by agencies.	RarePsp20
	Function Score for Pollinator Habitat					0.61	Wetlands with greater plant richness are likely to be more valuable to pollinators if other factors already suggest the wetland has high capacity to support pollinators.	ScorePOLf
	Function Score for Songbird, Raptor, & Mammal Habitat					0.74	Wetlands with greater plant richness are likely to be more valuable to supporting a variety of songbirds and mammals if other factors already suggest the wetland has high capacity to support those.	ScoreSBM

Species - Area	0.59	AVERAGE (Width, Size, SizeVegConn, SatPct)	SppArea
Landscape	0.42	AVERAGE (Beaver, NatVegCA, BuffLUpd, PondScape, PondProx)	Lscape
Aquatic Fertility	0.53	AVERAGE [MAX(CalcFen, Conduc, Acidic), Inflow, AVERAGE (Interspers, Fluc, SeasWpct, Groundw, Depth)]	AqFertilPD
Terrestrial Fertility	0.32	AVERAGE (Nfix, SoilTex, Karst, GDD)	TerrFertilPD
Competition/ Light	0.52	AVERAGE[Invas, AVERAGE(DecidCov, WoodyHtDiv, WoodHerbMix, HerbDom, Burn, Girreg)]	CompetPD
Stressors	0.54	[AVERAGE (Core1, Core2, BMPsoils, WeedSource) + AVERAGE(PopCtr, DistRd) + MIN(AltTime, Salt, SedDep, SedDisturb)]/3	StressPD

Function Score for Native Plant Habitat	F	5.07	IF((InvasDom1=1), 0, ELSE: (4*SppArea + 3*CompetPD + 2*AqFertilPD + 2*TerrFertilPD + LscapePD + StressPD)/13)
Benefits Score for Native Plant Habitat	B	10.00	IF((RarePlant=1),1, ELSE: AVERAGE(SBMscore, MAX(HerbUniq, WoodyUniq), ScorePOL)

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Public Use & Recognition	Prior designation of the wetland, by a natural resource or environmental protection agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research. The model assigns higher scores to greater visitor use. It does not account for some areas being valued more highly (e.g., as wilderness) because they have fewer visitors.	PU						
#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	If accessible, wetlands closer to population centers are likely to be visited by more people on foot.	PopCtrDisPU
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	The frequency of most recreational visits declines with increasing distance from roads.	DistRdPU
		<10 m.	1	8	8			
		10 - 25 m.	0	5	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	3	0			
		100 - 500 m.	1	2	2			
		>500 m.	0	1	0			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	People are naturally drawn to this region's coastal shorelines for recreation and occasionally for relief from summer heat.	TidalProxPU
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0			0.00	This reflects more widespread recognition of particular wetlands or their surroundings.	ConsDesig1
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0			0.00	Prior public investment for these purposes requires greater protection.	ConsInvest
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Mitigation wetlands represent an investment of funds in the public's interest, which should not be wasted.	MitigaSite
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Collection of long term data from wetlands is in the public interest partly because it can lead to more effective and fair regulations.	SciUse
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				0.25	Public ownership generally implies greater public use.	Ownership
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	4	0			
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0			
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	2	0			
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	1	1			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				*In calculations, if wetland is associated with a lake it counts positively; if not, this indicator is ignored in the calculations.*	LakePU
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	Public enjoyment of wetlands is assumed to be greater when most of the wetland can be seen without obstruction by dense shrubs or other features.	Visibility
		<25%.	0	0	0			
		25-50%.	0	1	0			
		>50%.	1	2	2			
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.67	Lack of physical barriers, provision of trails, and interpretive signs encourage greater public use of areas. However, some apparent barriers (e.g., deep water, dense brush) may be barriers only to summer recreation; frozen wetlands may enjoy considerable wintertime use.	RecreaPot
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	1				
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1				
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1				

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.60	The portion of a wetland that is accessible to visitors is assumed to be an important determinant of frequence of visitation	Core1PU
		<5% and no inhabited building is within 100 m of the AA.	0	4	0			
		<5% and inhabited building is within 100 m of the AA.	0	5	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	1	3	3			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	0	0	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.33	See above.	Core2PU
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	0	0			
		5-50%.	1	1	1			
		50-95%.	0	2	0			
		>95% of the AA.	0	3	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0			0.00	Such features and practices minimize damage to plants and wildlife and thus help sustain the natural features that attract people to wetlands.	BMPsoilsPU
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0			0.00	See above.	BMPwildPU

Convenience	0.53	AVERAGE(Ownership, Visibility, RdDist, Core1PU, Core2PU, ElevPU, PopCtrDisPU, TidalProxPU)	Conven
Investment	0.00	MAX(MitigaSite, ConsInvest, ConsDesig, SciUse)	Invest
Recreation Potential	0.22	AVERAGE(RecreaPoten, BMPsoils, BMPwildlife, LakePU)	RecPot

Benefits Score for Public Use & Recognition	B	2.51	AVERAGE(Convenience, Invest, RecPot)

Wetland Ecological Condition	The integrity or health of a wetland, as defined operationally by its vegetation composition and richness of native species. More broadly, the similarity of a wetland's structure, composition, and function with that of a reference wetland of the same type and landscape setting, operating within the bounds of natural or historical disturbance regimes (Adamus 1996).	EC

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				0.75	Rare native species are usually the first to disappear after a wetland is subjected to alteration of its water quality, hydrologic connectivity, or normal water or sediment regimes. Thus, their absence is sometimes indicative of past or ongoing impacts to the wetland's processes and condition.	RareAll
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	1	1	1			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	Lack of vegetative cover suggests a wetland may be in poor condition as a result of human-related impacts, but could also be the result of natural limitations or events.	BareGpct
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	3	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	1	1			
		Other conditions.	0	0	0			
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0					
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				1.00	Under natural unimpacted conditions, many but not all wetlands will have extensive microtopography.	GirregCQ
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	0	1	0			
		Several (extensive micro-topography).	1	2	2			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:					Strong dominance by one or a few species, even if those are natives, is sometimes an indicator of impaired ecological condition. However, newly created wetlands often have high richness of colonizing species. *In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.*	HerbDom1
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				0.75	Alteration of a wetland's water quality or its normal water or sediment regime is usually followed by invasion by non-native species, making these an indicator of past or ongoing alteration.	EmSens1_C
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	0	4	0			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	1	3	3			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				The model considers the presence (1) of this condition to indicate a somewhat degraded condition, but does not consider the absence (0) of this indicator a sign that a wetland is necessarily undegraded, so *if the condition is absent, the score is changed to blank and is not used by the model.*	OverRich

Score for Wetland Ecological Condition (Integrity)	EC	7.08	(MAX(RareAll, EmSens) + AVERAGE(HerbDom, GirregCQ, OverRich, BareGpct))/ 2

Wetland Sensitivity		A wetland's lack of intrinsic resistance and resilience to human and natural stressors (higher score = more sensitive).	Sen					
#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.60	Larger wetlands have a greater proportional area that is buffered against external disturbances and thus may be considered less sensitive. Small wetlands or more vulnerable to drying up as a result of climate change or changes in groundwater flow patterns, and many are poorly-buffered chemically against acifiying chemical inputs from precipitation (Freda 1986).	WetSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	1	3	3			
		10 to 100 hectares.	0	2	0			
		>100 hectares.	0	0	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.40	See above.	NatVegSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	0	3	0			
		100 to 1000 hectares.	1	2	2			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	0	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.83	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if they are contiguous with or close to other natural cover, especially if it is extensive, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegProx_S
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	0	0	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	1	0			
		50-500 m, and not separated.	0	2	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	4	0			
		0.5 - 5 km, but separated by those features.	1	5	5			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	6	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.60		VegPctScape_
		<5% of the land.	0	5	0			
		5 to 20% of the land.	0	4	0			
		20 to 60% of the land.	1	3	3			
		60 to 90% of the land.	0	2	0			
		>90% of the land. SKIP to OF10.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.00	See above.	PondProx_S
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	1	0			
		50-500 m, and not separated.	0	2	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	4	0			
		0.5 - 1 km, but separated by those features.	0	5	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	6	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:				0.50	Large water bodies often support high richness of wetland plants and animals, such that if a wetland is distant from a lake, recolonization of the wetland following impacts is likely to be slower.	LakeProx_S
		<100 m.	0	0	0			
		100 m - 1 km.	0	1	0			
		1 -2 km.	0	2	0			
		2-5 km.	1	3	3			
		5-10 km.	0	4	0			
		>10 km.	0	6	0			
OF16	Upland Edge Contact	Select one:				1.00	Longer wetland-upland edge relative to wetland area (i.e., convoluted edge) implies a wetland may be more vulnerable to invasive species, higher evapotranspiration, and other disturbances characteristic of adjoining uplands.	UpEdge_S
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.70	Wetlands near headwaters have less exposure to waterborne colonizing plant propagules, thus potentially longer recovery times and greater sensitivity.	Elev_S
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	The water regimes of wetlands whose catchments are small relative to wetland size are often more precarious and sensitive to landscape alterations (Fitzgerald et al. 2003).	CUratio_S
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetlands in regions with colder temperatures and shorter growing seasons take more time to recover from disturbances, and thus may be considered to be more sensitive.	GDD_S
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				1.00	Individuals belonging to species that are on the margins of their geographic range at this location tend to be more sensitive to some types of environmental disturbances.	RareSpp_S
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	1	1	1			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.75	Negative consequences of drought are greatest in peatlands, where large stores of organic matter in soils can be volatilised. Being groundwater dependent, fens are also sensitive to water table changes. Mosses and woody vegetation (shrub and forested wetlands) require many years to fully re-establish if removed or killed, i.e., resilience is less than for herbaceous vegetation. As compared with wooded wetlands, moss wetlands and seasonal marshes receive more off-road vehicle traffic with consequent degradation of soil and vegetation (Loomis & Lieberman 2006). Floodplain wetlands and marshes tend to be better buffered chemically than fens and especially bogs (Wood & Rubec 1989, Wisheu & Keddy 1994). Marshes tend to be more resilient partly because of their relatively high nutrient levels. Fens in some regions tend to be less sensitive to invasion by non-native plants (Magee & Kentula 2005), especially when shaded by a forest canopy. However, they are often highly sensitive to alteration of local water tables (Fitzgerald et al. 2003).	WettypeS
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	0	2	0			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	1	3	3			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				0.00	Tree cover is slower to recover than cover of herbaceous plants, making forested wetlands less resilient. *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	TreeCovS
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.				0.00	Larger-diameter trees are generally older, implying that recovery (resilience) from their loss will take longer than from loss of young trees. Resilience is one component of wetland sensitivity. In calculations, is excluded automatically (cell goes blank) if few or no trees are present.	TreeDBHs
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	1	0	0			
		coniferous, 10-19 cm diameter.	0	1	0			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:				0.00	Wetlands with fewer species may be less resistant to environmental change, and less resilient following disturbances. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodySens2_
		those species together comprise > 50% of such cover.	1	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:				0.00	High dispersion (fragmentation) of woody cover suggests recolonization of wetlands following disturbance may take longer when future disturbances occur, due to less intact corridors with similar cover types. In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.	ShrubPattS
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	1	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				1.00	Because of its ability to fertilize soil, alder can speed biological recovery following disturbance [Gomi et al. 2006]. Wetlands without alder may be slower to recover and thus more sensitive.	NfixS
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	5	5			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.67	If vegetation cover in a wetland is already sparse, it is often more susceptible to further loss from erosion and altered microclimate.	Gcover_S
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	0	0	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	1	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	1	2	2			
		Other conditions.	0	3	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.25	Organic soils are particularly sensitive because slight changes in the water table often cause rapid decomposition and/or compaction (subsidence) of this substrate, resulting in major shifts in characteristic plants and animal species as well as biogeochemical processes. Coarse soils are most resistant to compaction, though they are less moisture-retentive and dry out quickly.	SoilTex_S
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	1	1	1			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	0	4	0			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:					Simply because they tend to have more species, wetlands with a predominance of native species have more species to lose and thus could be considered to be more sensitive to impacts. In contrast, once wetlands become dominated by non-native (exotic) species, the plant community structure is simplified (e.g., Perkins & Willson 2005). Non-natives tend to have broad environmental tolerances, so wetlands dominated by them and thus having low species richness are more resistant to further change (Werner & Zedler 2002, Wigand et al. 2003). By itself, increased species richness in a wetland does not always confer increased resistance (decreased sensitivity) of a wetland's functions to artificial changes (e.g., Engelhardt & Kadlec 2001). In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.	HerbDom2
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	1	0			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				0.00	Wetlands already dominated by non-native invasive species are likely to be more resistant to further impacts to their remaining plant communities from additional invasive plant species (Werner et al. 2002, Wigand et al. 2003, Stohlgren et al. 2002),	EmSens1_S
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	0	4	0			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	1	3				
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.60	Wetlands that are only saturated (no surface water) are more susceptible to year-to-year differences in precipitation, runoff, and flow. Some also are more vulnerable to invasion by non-native upland plants (Magee & Kentula 2005). In contrast, persistently-inundated wetlands tend to be deeper and have more "buffer" against annual variation in available water.	SatPct_S
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	1	3	3			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	0	4	0			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Decreases in water inputs will have the greatest impact on shallow wetlands, even causing parts of them to cease being wetlands, and causing major changes in species and biogeochemical processes in the remaining wetland. Also, among wetlands having the same area, shallow wetlands have less volume than deeper ones and thus experience less dilution of incoming contaminants. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.	Depth_S
		<10 cm deep (but >0).	0	4	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.20	Ponded waters are more susceptible to developing oxygen deficits and bioaccumulating contaminants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry_S
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Narrow wetlands tend to be more susceptible to erosion from waves and currents. Their microclimate also is more precarious, trees are more subject to windthrow (Martin & Grotenfendt 2007, Bahuguna et al. 2010), and their wildlife may be more susceptible to predation. In narrow strips or small patches of vegetation, the native plant communities are more vulnerable to invasion from non-native species from adjoining lands (Hennings & Edge 2003). A study in Alberta found that non-native plants within forests there were most abundant between 15 and 50 ft from the edge, and some of those species were found up to 130 ft from the edge. Although larger patches of forest generally supported more non-natives species than smaller fragments, the smallest fragments had the greatest number of non-native species per square meter (Gignac & Dale 2007). Wooded buffers with dense vegetation tend to restrict wind-driven dispersal of seeds of non-native plants into the area protected by a buffer (Cadenzas & Pickett 2001). If the adjoining uplands are not forested, a greater proportion of the trees in narrow wetlands are subject to blowdown, and the wetland's plants and animals are more subject to extremes of the surrounding microclimate as well as disturbance from humans in nearby uplands. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	VwidthAbs_S
		<1 m.	0	6	0			
		1 - 9 m.	0	4	0			
		10 - 29 m.	1	3	3			
		30 - 49 m.	0	2	0			
		50 - 100 m.	0	1	0			
		> 100 m, or open water is absent at that time.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.00	If a wetland lacks surface water outflow, nearly all contaminants that enter it will remain and be accumulated over time (Oberts 1977). This is particularly true of runoff-borne sediment, which can eventually fill a wetland and thus destroy it (Whited 2001, Whigham & Jordan 2003, Leibowitz 2003).	OutDura_S
		Persistent (surface water flows out for >9 months/year).	1	0	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	0	1	0			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	4	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	5	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.00	Narrow outlets limit water outflow from a wetland and thus tend to cause the wetland to confine and accumulate sediment that has been washed in. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric_S
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	2	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	1	0	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	1	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F47	pH Measurement	The pH in most of the AA's surface water:					Low-pH wetlands are particularly sensitive to further acidification by acid rain. They are often darkly tea-coloured due to tannins associated with humic acids. *In calculations, the indicator score is set to 1 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	AcidicS
		Was measured, and is: [enter the reading in the column to the right.]	6.30					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				1.00	Wetlands with lower conductivity or TDS generally (but not always) have lower alkalinity, which otherwise would buffer the wetland's chemistry against large changes induced by acid rain. In calculations, the indicator score is set to 1 if TDS<300 mg/L or conductivity is <600 µS/cm or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.	ConductivS
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	26					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	54					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				0.00	Wetlands whose existence or extent depends on beaver are more sensitive in the sense that they may not be sustained naturally over time if beaver populations and associated beaver dams decline.	Beaver_S
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	0	3	0			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.33	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if large and/or surrounded by other natural landscapes, and/or if they are near other wetlands of the same type, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegCUpct_
		<5%.	0	0	0			
		5 to 30%.	1	2	2			
		30 to 60%.	0	3	0			
		60 to 90%.	0	4	0			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.40	Wetlands adjoined by steep slopes are likely to be subject to more sediment and contaminant input, other factors being equal.	BuffSlope_S
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	0	1	0			
		5-30%.	1	2	2			
		>30%.	0	5	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Man-made wetlands typically have less diverse vegetation and limited soil carbon, making them more sensitive to extreme natural events and slower to recover.	NewWet_S
		No.	0	0	0			
		Yes, and created or expanded 20 - 100 years ago.	0	1	0			
		Yes, and created or expanded 3-20 years ago.	0	2	0			
		Yes, and created or expanded within last 3 years.	0	3	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Abiotic Resistance/ Sensitivity	0.11	AVERAGE [OutDura X AVERAGE(SatPct, CUratio, IsoDry, Depth, Constric), AVERAGE(BuffSlope, SoilTex, Beaver)]	AbioSens
Biotic Resistance/ Sensitivity	0.61	AVERAGE [AVERAGE[VwidthAbs, WetSize, (AVERAGE(EmSens, ShrubPattS, WoodySens2, Gcover, UpEdge)), RareSpp]	BioSens
Resilience/ Recovery Duration - Site Fertility & Climate	0.90	AVERAGE[GDD, AVERAGE(Wettype, Nfix, NewWet, Acidic, Conductiv)]	Fertility
Resilience/ Recovery Duration - Colonizer Availability Influence	0.48	AVERAGE(HerbDom, Elev, NatVegProx, NatVegSize, NatVegCUpct, PondProx, LakeProx)	Colonizer
Resilience/ Recovery Duration - Veg Growth Rate Influence	0.00	AVERAGE(TreeDBHs, TreeCover)	GrowthRate

Score for Wetland Sensitivity	SEN	4.19	AVERAGE(AbioSens, BioSens, Fertility, Climate, Colonizer, GrowthRate)

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Wetland Stressors		The degree to which a wetland is, or has recently been altered by, or exposed to risk from, factors capable of reducing one or more of its functions and which are primarily human-related.	STR				
#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	PopCtrDist
		<100 m.	0	5	0		
		100 - 500 m.	0	3	0		
		0.5- 1 km.	0	2	0		
		1 - 5 km.	1	1	1		
		>5 km.	0	0	0		
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	DistRd
		<10 m.	1	5	5		
		10 - 25 m.	0	4	0		
		25 - 50 m.	0	2	0		
		50 - 100 m.	0	1	0		
		100 - 500 m.	1	1	1		
		>500 m.	0	0	0		
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			1.00	RdBox
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					ToxicData
		The condition is present within the AA.	0				
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0				
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing	0				
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1				
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.67	CAimperv
		<10%.	0	0	0		
		10 to 25%.	1	2	2		
		>25%.	0	3	0		
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				1.00	OwnerSS
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	0	0		
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0		
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	1	0		
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	2	2		
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				0.33	WeedSource
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	0	0	0		
		some (but <5%) of the upland edge.	1	1	1		
		5-50% of the upland edge.	0	2	0		
		most (>50%) of the upland edge.	0	3	0		
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.00	Constricted
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	0	1	0		
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	1	0	0		
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0		
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.75	NatVegCA
		<5%.	0	4	0		
		5 to 30%.	1	3	3		
		30 to 60%.	0	2	0		
		60 to 90%.	0	1	0		
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0		
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	BuffDisturbTyp
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0		
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1		
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.00	BurnHist
		Burned within past 5 years.	0	4	0		
		Burned 6-10 years ago.	0	3	0		
		Burned 11-30 years ago.	0	2	0		
		Burned >30 years ago, or no evidence of a burn and no data.	1	0	0		
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	VisibWet
		<25%.	0	0	0		
		25-50%.	0	1	0		
		>50%.	1	2	2		

#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.50	RecUse
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	1	1		
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1	1		
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1	0		
		The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]	0	1	0		
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.40	Core1
		<5% and no inhabited building is within 100 m of the AA.	0	5	0		
		<5% and inhabited building is within 100 m of the AA.	0	5	0		
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0		
		5-50% and inhabited building is within 100 m of the AA.	1	2	2		
		50-95%, with or without inhabited building nearby.	0	1	0		
		>95% of the AA with or without inhabited building nearby.	0	0	0		
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.33	Core2
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	0	0	0		
		5-50%.	1	1	1		
		50-95%.	0	3	0		
		>95% of the AA.	0	3	0		
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.25	AltTiming
S2	Accelerated Inputs of Contaminants and/or	Stressor subscore=	0			0.44	Toxic
S3	Accelerated Inputs of Nutrients	Stressor subscore=	0			0.44	Enrich
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.58	SedLoad
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0			0.33	SoilDisturb

Hydrologic Stressors	0.13	AVERAGE(AltTiming, Constricted)	HydroStress
Water Quality Stressors	0.50	AVERAGE(Toxic, ToxicData, Enrich, SedLoad, SoilDisturb, CAimperv, BuffDisturbTyp)	WQstress
Fragmentation Stressors	0.69	AVERAGE(NatVegCA, RdBox, WeedSource)	FragStress
Disturbance Stressors	0.55	AVERAGE(RecUse, Core1, Core2, DistRd, VisibWet, PopCtrDist, Owner, BurnHist)	DisturbStress

Score for Stressors to Wetland	S	5.81	(MAX(HydroStress, WQstress, FragStress, DisturbStress)) + AVERAGE(HydroStress, WQstress, FragStress, DisturbStress))/2

Cover Page: Basic Description of Assessment	WESP-AC version 2
Site Name:	WL-7-WM
Investigator Name:	Zacharye Simai
Date of Field Assessment:	July 14, 2022
Nearest Town:	Westchester Mountain, NS
Latitude (decimal degrees):	45.567734
Longitude (decimal degrees):	-63.752673
Is a map based on a formal on-site wetland delineation available?	Yes
Approximate size of the Assessment Area (AA, in hectares):	2.78
AA as percent of entire wetland (approx.). Attach sketch map if AA is smaller than the entire contiguous wetland.	50
What percent (approx.) of the wetland were you able to visit?	50
What percent (approx.) of the AA were you able to visit?	100
Were you able to ask the site owner/manager about any of the questions?	No
Indicate here if you intentionally surveyed for rare plants, calciphile plants, or rare animals:	Yes
Have you attended a WESP-AC training session? If so, indicate approximate month & year.	Yes
How many wetlands have you assessed previously using WESP-AC? (approx.)	50+
Comments about the site or this WESP-AC assessment (attach extra page if desired):	

Date: October 13, 2022	Site Identifier: WL-7-WM	Investigator: Kelly Regan

Form OF (Office). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia wetlands only. DIRECTIONS: Conduct an assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answering many of the questions below will require using these online map viewers:

Google Earth Pro: https://www.google.com/earth/download/gep/agree.html

Provincial Landscape Viewer: https://nsgi.novascotia.ca/plv/

For most wetlands, completing this office data form will require 1-2 hours. For a list of functions to which each question pertains, see bracketed abbreviations in the Definitions/Explanations column. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF1	Province	Mark the province in which the AA is located by changing the 0 in the column next to it to a "1". Mark only one.		This determines to which province's calibration wetlands the raw score of any wetland is normalised. In the function and benefits models, it also triggers the automatic exclusion of indicators for which no spatial data exists in a particular province.
		New Brunswick	0	
		Nova Scotia	1	
		Prince Edward Island	0	
		Newfoundland-Labrador	0	
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		"Adjacent" means not separated from the AA by a wide expanse (>50 m) of upland (including roads >50 m wide). Include ponded areas likely to be hidden by wetland vegetation. If surface water extends beyond 1 km, include only the part within 1 km. Do not include tidal areas. Measure the area from aerial imagery using Google Earth Pro (click on Ruler icon in toolbar, then Polygon in pop-up menu). [PH, SBM, WBN]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	1	
		1 to 10 hectares.	0	
		10 to 100 hectares.	0	
		>100 hectares.	0	
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:		See definition of adjacent in OF2. If the AA's wetland vegetation extends beyond 1 km, include only the part within 1 km. "Ponded" means not flowing in rivers or streams. [Sens, WBF]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	1	
		1 to 10 hectares.	0	
		10 to 100 hectares.	0	
		>100 hectares.	0	
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:		See definition of adjacent in OF2. Use Google Earth Pro's polygon ruler (as described above). Exclude conifer plantations only if it is obvious that trees were planted in rows. [AM, PH, SBM, Sens]
		<0.01 hectare (about 10 m x 10 m).	0	
		0.01 - 0.1 hectare.	0	
		0.1 - 1 hectare.	0	
		1 to 10 hectares.	0	
		10 to 100 hectares.	0	
		100 to 1000 hectares.	1	
		>1000 hectares. [*This is nearly always the answer in relatively undeveloped landscapes.*]	0	
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest *vegetated land* (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:		To measure distance, use Google Earth Pro (Ruler > Line tool). The 375-ha criterion is from the Fundy Model Forest Project. [AM, PH, POL, SBM, Sens]
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	
		50-500 m, and not separated.	0	
		50-500 m, but separated by those features.	0	
		0.5 - 5 km, and not separated.	0	
		0.5 - 5 km, but separated by those features.	0	
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1	For this question only, consider moss to be herbaceous vegetation. Determine the score by viewing aerial imagery in Google Earth after successively drawing or estimating the boundaries of the buffers of 5 km, 1 km, and 100 m radius focused on the center of the AA. Circles of specified radius can be drawn in Google Earth Pro by clicking on the Ruler icon, then Circle in the pop-up menu. [AMv, PHv, POLv, SBMv, WBFv, WBNv]
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	0	See above. Do not consider conifer plantations to be forest if it is obvious that trees were planted in rows. [AMv, PHv, POLv, SBMv]
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:		In Google Earth, draw the 5 km buffer and then estimate land cover percentages, or do GIS analysis of an appropriate land cover layer. [AM, PH, POL, SBM, Sens]
		<5% of the land.	0	
		5 to 20% of the land.	0	
		20 to 60% of the land.	0	
		60 to 90% of the land.	1	
		>90% of the land. SKIP to OF10.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:		[AM, SBM]
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:		"Population center" means a settled area with more than about 5 regularly- inhabited structures per square kilometer. In Google Earth Pro, click on the Ruler icon, then Path, and draw and measure the route. [FAv, FRv, NRv, PH, PU, SBM, WBFv]
		<100 m.	0	
		100 - 500 m.	0	
		0.5- 1 km.	0	
		1 - 5 km.	1	
		>5 km.	0	
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:		Determine this by viewing aerial imagery in Google Earth Pro and measuring with the Ruler>Line tool. [AM, FAv, FRv, NRv, PH, PU, SBM, STR, WBN]
		<10 m.	0	
		10 - 25 m.	0	
		25 - 50 m.	0	
		50 - 100 m.	0	
		100 - 500 m.	0	
		>500 m.	1	
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0	Draw the 5 km circle in Google Earth Pro using the Circle tool and search for roads and wetlands within it, being alert for roads hidden under forest canopy. [AM, SBM, STR]
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:		In Google Earth Pro, zoom in closely to examine the surrounding landscape for ponds, lakes, and wetlands that appear to be permanently flooded. [AM, PH, SBM, Sens, WBF, WBN]
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	
		<50 m, but completely separated by those features.	0	
		50-500 m, and not separated.	1	
		50-500 m, but separated by those features.	0	
		0.5 - 1 km, and not separated.	0	
		0.5 - 1 km, but separated by those features.	0	
		None of the above (the closest patches or corridors that large are >1 km away).	0	
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:		Determine this by viewing aerial imagery in Google Earth. [Sens, WBF, WBN]
		<100 m.	0	
		100 m - 1 km.	0	
		1 -2 km.	0	
		2-5 km.	1	
		5-10 km.	0	
		>10 km.	0	
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:		In Google Earth, measure the distance to the ocean (including Bay of Fundy) or tidal river, whichever is closer. If you need to see how far upriver a river is tidal, see the KMZ file provided with this calculator for NS (NS Headtide). Points shown in those files are only an approximation, so local information if available may be preferable. [FA, WBF]
		<100 m.	0	
		100 m - 1 km.	0	
		1 - 5 km.	0	
		5-10 km.	0	
		10-40 km.	1	
		>40 km.	0	
OF16	Upland Edge Contact	Select one:		[NR, SBM, Sens]
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):		Contact local authories to determine if such maps exist. Where available, LiDAR imagery can provide finer elevational resolution useful for flood modeling. [WSv]
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).	0.98	[FA, NR, Sens, SFSv, WCv, WSv]
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0	If an ACCDC report is available for this AA, it also may contain such information. [NRv]

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:		May use existing data, or sample those waters as part of this wetland assessment. "Harmful" should be evaluated with regard to current federal or provincial water quality standards. [AM, FA, FR, NRv, PRv, SRv, STR, WBF, WBN]
		The condition is present within the AA.	0	
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0	
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:		May use existing data, or monitor waters as part of this wetland assessment. [NRv, PRv, SRv]
		The condition is present within 1 km downslope and connected to the AA by a channel.	0	
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0	
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0	
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1	
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:		Topographic maps may be viewed online at the National Atlas of Canada (Toporama): http://atlas.gc.ca/toporama/en/index.html [NR, PR, Sens, SR, WS]
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	
		0.01 to 0.1.	0	
		0.1 to 1.	1	
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :		[FA, INV, NRv, PRv, SRv, STR, WCv, WSv]
		<10%.	1	
		10 to 25%.	0	
		>25%.	0	
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:		[NRv, PRv, SRv, WSv]
		Mostly true.	0	
		Somewhat true.	0	
		Mostly untrue.	1	
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:		[AM, NR, SFS, WC, WS]
		Northward (N, NE). north-facing contributing area.	0	
		Southward (S, SW). south-facing contributing area.	0	
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:		Identify inlets and outlets, if any, from topographic maps (use elevations to determine which are inlets and which are outlets) and augment by field inspection. With the Provincial Landscape Viewer, select Nova Scotia Topo as the Basemap. Also enable the layer Forestry>WAM Predicted Flow. Then measure the inlet-outlet distance. [NR, OE, PR, SR, WS]
		<10 m.	0	
		10 - 50 m.	0	
		50 - 100 m.	0	
		100 - 1000 m.	1	
		1- 2 km.	0	
		>2 km, or wetland lacks an inlet and outlet.	0	
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903	This layer was provided by Dr. Dan McKenney of the Canadian Forest Service [AM, CS, FR, INV, NR, OE, PH, PR, Sens, SR, WBF, WCv, WS]
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [*Mark just the first choice that is true.]* :		Regarding the last choice, if uncertain if an AA is fishless, consider the possibility its waters have been stocked. [AM, FA, FR, INV, WBF, WBN]
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites: http://www.salmonatlas.com/atlanticsalmon/canada-east/index.1.html http://atlanticsalmonfederation.org/rivers/introduction.html	0	
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented *[mark all applicable*]:		Request information from ACCDC and/or conduct your own survey at an appropriate season using an approved protocol. For birds, also check eBird.org. NOTE for NS: If your WESP-AC is being completed for a Wetland Alteration Application to NS-ECC, your ACCDC results and any taxon-specific survey results must be submitted along with your WESP-AC results, and application. [AMv, EC, PHv, POLv, SBMv, Sens, WBFv, WBNv]
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0	
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	
		None of the above, or no data.	0	
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0	The source of this layer, which should be checked periodically for updates, is: http://www.ibacanada.com/mapviewer.jsp?lang=EN [SBMv, WBFv, WBNv]
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.		This was provided by Dr. David Leske. [WBNv]

#	Indicators	Condition Choices	Data	Definitions/Explanations
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1	[SBM]
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0	See: https://novascotia.ca/parksandprotectedareas/plan/interactive-map/ [PU]
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0	[PU]
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0	[PU]
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.		[AM, FA, FR, INV, PH]
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.		"Private lands" may include those owned or leased by non-governmental organizations, e.g., charitable conservation land trusts, DUC, TNC. [PU, STR]
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	

Date: July 14, 2022	Site Identifier: WL-7-WM	Investigator: Zacharye Simai

Form F (Field). Non-tidal Wetland Data Form. WESP-AC version 2 for Nova Scotia. DIRECTIONS: Walk for no less than 10 minutes from the wetland edge towards its core, in the part of the AA that is proposed for alteration. If no alteration is proposed, walk in a portion that appears to be most representative of the wetland overall. Walk only where it is safe and legal to do so. Conduct the assessment only after reading the accompanying Manual and the Explanations column of the data form. In the Data column, change the 0 (false) to a 1 (true) for the best choice, or for multiple choices where allowed and so indicated. Answer these questions primarily based on your onsite observations and interpretations. Do not write in shaded parts of this data form. Answering some questions accurately may require conferring with the landowner or other knowledgable persons, and/or reviewing aerial imagery. For most wetlands, completing this field data form will require 1-2 hours on a site. For a list of functions to which each question pertains, see the accompanying Interpretations form. For detailed descriptions of each WESP-AC model, see Appendix B of the accompanying Manual. Codes for functions and values are: WS= Water Storage & Delay, SFS= Stream Flow Support, WC= Water Cooling, SR= Sediment Retention & Stabilisation, PR= Phosphorus Retention, NR= Nitrate Removal, CS= Carbon Sequestration, OE= Organic Nutrient Export, INV= Invertebrate Habitat, FA= Anadromous Fish Habitat, FR= Resident Fish Habitat, AM= Amphibian & Reptile Habitat, WBF= Feeding Waterbird Habitat, WBN= Nesting Waterbird Habitat, SBM= Songbird, Raptor, & Mammal Habitat, POL= Pollinator Habitat, PH= Native Plant Habitat, PU= Public Use & Recognition, EC= Ecological Condition, Sen= Wetland Sensitivity, STR= Stressors.

#	Indicators	Condition Choices	Data	Definitions/Explanations
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:		Ericaceous shrubs are ones in the heather family (Ericaceae). Most have leathery evergreen leaves. They include rhododendron, azalea, swamp laurel, leatherleaf, Labrador tea, and others. Most require acidic soil. Although not in the family Ericaceae, sweetgale (*Myrica gale*) should be counted also. [AM, CS, FA, FR, INV, NR, OE, PH, Sens, SFS, WBF, WBN]
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.		
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (*Carex rariflor* a). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:		
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	
Reminder: For all questions, the AA should include all persistent waters in ponds smaller than 8 hectares (~283 m on a side) that are adjacent to the AA. The AA should also include part of the water area of adjacent ponded water larger than 8 ha and adjacent rivers wider than 20 m. Specifically, the AA should include the open water part adjacent to wetland vegetation and equal in width to the average width of that vegetated zone. Throughout this data form, " adjacent " is used synonymously with abutting, adjoining, bordering, contiguous -- and means no upland (manmade or natural) completely separates the described features along their directly shared edge. Features joined only by a channel are not necessarily considered to be adjacent -- a large portion of their edges must match. The features do not have to be hydrologically connected in order to be considered adjacent.				
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, INV, SBM, WBF]
		A1.	0	
		A2.	0	
		B1.	0	
		B2.	0	
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.		Deciduous shrubs in this region usually include buttonbush, Labrador tea, bayberry (*Morella*), huckleberry, cranberry, cloudberry, sweetgale, alder, willow, birch, ash, dogwood, and a few others. If you assigned a code of 3 or higher to any of the first four choices and the ground cover beneath the trees/shrubs is <25% moss, then question F1 might be "B1". [CS, INV, NR, PH, POL, SBM, Sens]
		coniferous trees (may include tamarack) taller than 3 m.	1	
		deciduous trees taller than 3 m.	1	
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1	
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1	
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1	
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1	
Note: If none of top 4 rows in F3 was marked 2 or greater, SKIP to F9 (N fixers).				
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:		[PH, POL, SBM, Sens]
		those species together comprise > 50% of such cover.	0	
		those species together do not comprise > 50% of such cover.	0	
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.		Estimate the diameters at chest height. If small-diameter trees are overtopped (shaded) by larger ones, visualise a "subcanopy" at the average height of the smaller-dbh trees, to serve as a basis for the minimum 5% canopy requirement in this question. The trees and shrubs need not be wetland species. [AM, CS, POL, SBM, Sens, WBN]
		coniferous, 1-9 cm diameter and >1 m tall.	0	
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	
		coniferous, 10-19 cm diameter.	0	
		broad-leaved deciduous 10-19 cm diameter.	0	
		coniferous, 20-40 cm diameter.	0	
		broad-leaved deciduous 20-40 cm diameter.	0	
		coniferous, >40 cm diameter.	0	
		broad-leaved deciduous >40 cm diameter.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:		[AM, INV, NR, PH, SBM, Sens]
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.		
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:		
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:		Snags are dead standing trees that often (not always) lack bark and foliage. Include only ones that are at least 2 m tall. [POL, SBM, WBN]
		None, or fewer than 8/ hectare which exceed this diameter.	0	
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	
		Several (>8/hectare) but above not true.	0	
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:		Exclude temporary "burn piles." [AM, INV, POL, SBM]
		Few or none that meet these criteria.	0	
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:		Do not include N-fixing algae or lichens. [FA, FR, INV, NRv, OE, PH, SBM, Sens]
		<1% or none.	0	
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:		Exclude moss growing on trees and rocks. [CS, PH]
		<5% of the vegetated part of the AA.	0	
		5-25% of the vegetated part of the AA.	0	
		25-50% of the vegetated part of the AA.	0	
		50-95% of the vegetated part of the AA.	0	
		>95% of the vegetated part of the AA.	1	
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:		Thatch is dead plant material (stems, leaves) resting on the ground surface. Bare ground that is present under a tree or shrub canopy should be counted. Boulders count as bare ground. Wetlands with mineral soils and that are heavily shaded or are dominated by annual plant species tend to have more extensive areas that are bare during the early growing season. [AM, EC, INV, NR, OE, POL, PR, SBM, Sens]
		Little or no (<5%) *bare ground* is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	
		Other conditions.	0	
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0	
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:		The depressions may be of human or natural origin. [AM, EC, INV, NR, PH, POL, PR, SBM, SR, WS]
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	
		Intermediate.	1	
		Several (extensive micro-topography).	0	
F13	Upland Inclusions	Within the AA, inclusions of upland are:		[AM, NR, SBM]
		Few or none.	1	
		Intermediate (1 - 10% of vegetated part of the AA).	0	
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [*To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]*		[CS, NR, OE, PH, PR, Sens, SFS, WS]
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	
		Deep Peat, to 40 cm depth or greater.	0	
		Shallow Peat or organic <40 cm deep.	1	
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]		This addresses needs of many but not all migratory sandpipers, plovers, and related species. [WBF]
		None, or <100 sq. m.	1	
		100-1000 sq. m.	0	
		1000 – 10,000 sq. m.	0	
		>10,000 sq. m.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:		[AM, WBF, WBN]
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	
		5-25% of the vegetated part of the AA.	0	
		25-50% of the vegetated part of the AA.	0	
		50-95% of the vegetated part of the AA.	0	
		>95% of the vegetated part of the AA.	1	
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:		Forbs are flowering plants. Do not include grasses, sedges, cattail, other graminoids, ferns, horsetails, or others that lack showy flowers. [POL]
		<5% of the herbaceous part of the AA.	0	
		5-25% of the herbaceous part of the AA.	1	
		25-50% of the herbaceous part of the AA.	0	
		50-95% of the herbaceous part of the AA.	0	
		>95% of the herbaceous part of the AA.	0	
F18	Sedge Cover	Sedges (*Carex* spp.) and cottongrass (*Eriophorum* spp.) occupy:		[CS]
		<5% of the vegetated area, or none.	0	
		5-50% of the vegetated area.	1	
		50-95% of the vegetated area.	0	
		>95% of the vegetated area.	0	
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:		For this question, include ferns as well as graminoids and forbs. [EC, INV, PH, POL, Sens]
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.		[EC, PH, POL, Sens]
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:		If a plant cannot be identified to species (e.g., winter conditions) but its genus contains an exotic species, assume the unidentified plant to also be exotic. If vegetation is so senesced that exotic species cannot be identified, answer "none". [PH, STR]
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	
		some (but <5%) of the upland edge.	0	
		5-50% of the upland edge.	0	
		most (>50%) of the upland edge.	0	
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0	[WBF, WBN, WCv]
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0	[FR, PR, PU, WBF, WBN]
F24	% of AA Without Surface Water	The percentage of the AA that <u>never</u> contains <u>surface</u> water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:		1 hectare is 10,000 sq. m or about 2.5 acres. It could have dimensions of 100 m by 100 m, 1000 m by 10 m, or similar. [AM, FA, FR, INV, NR, PH, PR, SBM, Sens, SRv, WBF, WBN, WC]
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	
		25-50% of the AA never contains surface water.	0	
		50-75% of the AA never contains surface water.	0	
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:		If you are unable to determine the condition at the driest time of year, ask the land owner or neighbors about it if possible. Indicators of persistence may include fish, some dragonflies, beaver, and muskrat. [AM, CS, FA, FR, INV, NR, POL, PR, SBM, WBF, WBN]
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	
		1-20% of the AA.	1	
		20-50% of the AA.	0	
		50-95% of the AA.	0	
		>95% of the AA. True for many fringe wetlands.	0	
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water <u>within</u> the AA that is shaded by vegetation and other features that are <u>within</u> the AA at that time is:		[FA, WC]
		<5% of the water is shaded, or no surface water is present then.	0	
		5-25% of the water is shaded.	1	
		25-50% of the water is shaded.	0	
		50-75% of the water is shaded.	0	
		>75% of the water is shaded.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:		Flood marks (algal mats, adventitious roots, debris lines, ice scour, etc.) are often evident when not fully inundated. Also, such areas often have a larger proportion of upland and annual (vs. perennial) plant species. In riverine systems, the extent of this zone can be estimated by multiplying by 2 the bankful height and visualising where that would intercept the land along the river. [CS, FA, INV, NR, OE, PH, SR, WBF, WBN, WS]
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	
		1-20% of the AA, or <1% but >0.01 ha.	1	
		20-50% of the AA.	0	
		50-95% of the AA.	0	
		>95% of the AA.	0	
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:		Look for flood marks (see above). Because the annual range of water levels is difficult to estimate without multiple visits, consider asking the land owner or neighbors about it. [AM, CS, INV, NR, OE, PH, PR, SR, WBN, WS]
		<10 cm change (stable or nearly so).	0	
		10 cm - 50 cm change.	1	
		0.5 - 1 m change.	0	
		1-2 m change.	0	
		>2 m change.	0	
Is the AA plus adjacent ponded water smaller than 0.01 hectare (about 10m x 10m, or 1m x 100 m)? If so, enter "1" in column D and SKIP TO F42 (Connection).			0	
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:		If a boat is unavailable, estimate this by considering wetland size and local topography. Or if timing and safety allow, depths may be measured by drilling through winter ice.This question is asking about the spatial median depth that occurs during most of that time, even if inundation is only seasonal or temporary. If inundation in most but not all of the wetland is brief, the answer will be based on the depth of the most persistently inundated part of the wetland. Include surface water in channels and ditches as well as ponded areas. [CS, FA, FR, INV, OE, PH, PR, Sens, SFS, SR, WBF, WBN, WC]
		<10 cm deep (but >0).	0	
		10 - 50 cm deep.	1	
		0.5 - 1 m deep.	0	
		1 - 2 m deep.	0	
		>2 m deep. True for many fringe wetlands.	0	
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):		Estimate these proportions by considering the gradient and microtopography of the site. [FR, INV, WBF, WBN]
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question above).	1	
		One depth class that comprises 50-90% of the AA's inundated area.	0	
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:		Nearly all wetlands with surface water have some ponded water. [AM, CS, INV, NR, OE, PR, Sens, SR, WBF, WBN, WC, WS]
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	
		5-30% of the water.	0	
		30-70% of the water.	0	
		70-95% of the water.	0	
		>95% of the water.	0	
F32	Ponded Open Water - Minimum Size	During most of the growing season, the largest patch of open water that is ponded and is in or bordering the AA is >0.01 hectare (about 10 m by 10 m) and mostly deeper than 0.5 m. If true enter "1" and continue, If false, enter "0" and SKIP to F41 (Floating Algae & Duckweed).	0	Open water is not obscured by vegetation in aerial ("duck's eye") view. It includes vegetation floating on the water surface or entirely submersed beneath it.
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:		[AM, CS, FA, FR, INV, NR, OE, PR, SR, WBF, WBN, WC]
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	
		5-30% of the ponded water.	0	
		30-70% of the ponded water.	0	
		70-99% of the ponded water.	0	
		100% of the ponded water.	0	
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:		"Vegetated area" does not include underwater or floating-leaved plants, i.e., aquatic bed. Width may include wooded riparian areas if they have wetland soil or plant indicators. [AM, CS, NR, OE, PH, PR, SBM, Sens, SR, WBN]
		<1 m.	0	
		1 - 9 m.	0	
		10 - 29 m.	0	
		30 - 49 m.	1	
		50 - 100 m.	0	
		> 100 m, or open water is absent at that time.	0	
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water) is:		If several isolated pools are present in early summer, estimate the percent of their collective shorelines that has such a gentle slope. [SR, WBN]
		<1% of the water edge.	0	
		1-25% of the water edge.	0	
		25-50% of the water edge.	0	
		50-75% of the water edge.	0	
		>75% of the water edge.	1	
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (*Typha* spp.), common reed (*Phragmites*), or tall (>1m) bulrush is:		Emergent vegetation is herbaceous plants whose stems are partly above and partly below the water surface during most of the time water is present. [WBN]
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1	
		1-25% of the emergent vegetation.	0	
		25-75% of the emergent vegetation.	0	
		>75%, of the emergent vegetation.	0	
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:		[AM, FA, FR, INV, NR, OE, PH, PR, SBM, SR, WBF, WBN]
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	
		Intermediate.	0	
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	
F38	Persistent Deepwater Area	If the deepest patch of surface water (flowing or ponded) in or directly adjacent to the AA is mostly deeper than 0.5 m for >2 weeks during the growing season, enter "1" and continue. If not, enter "0" and SKIP to F42.(Connection).	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:		For this question, consider only the wood that is at or above the water surface. Estimates of underwater wood based only on observations from terrestrial viewpoints are unreliable so should not be attempted. [AM, FA, FR, INV]
		Little or none.	0	
		Intermediate.	0	
		Extensive.	0	
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0	[WBN]
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0	[EC, PR, WBF]
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]		Consider the connection regardless of whether the surface water is frozen. The "downslope stream network" could consist of ditches, rivers, ponds, or lakes which eventually connect to the ocean. If this cannot be determined while visiting the AA, consult topographic maps perhaps by viewing these online with Toporama (http://atlas.nrcan.gc.ca/toporama/en/index.html) [CS, FA, FR, NR, OE, PR, Sens, SFS, SR, WCv, WS]
		Persistent (surface water flows out for >9 months/year).	0	
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:		"Major runoff events" would include biennial high water caused by storms and/or rapid snowmelt. [CS, NR, OE, PR, Sens, SR, STR, WS]
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	0	
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1	If inlet tributaries cannot be searched for due to inaccessibility of part of the AA, follow suggestions in F42 above. [NRv, PH, PRv, SRv]
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	1	[WCv]
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].		[FA, FR, INV, NR, OE, PR, SR, WS]
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	
F47	pH Measurement	The pH in most of the AA's surface water:		Preferably, measure this in larger areas of ponded surface water within the AA, or in streams that have passed through (not along) most of the AA. Unless surface water is completely absent, do not dig holes or make depressions in peat in order to provide water for this measurement. Avoid measuring near roads or in puddles formed only by recent rain. [AM, FA, FR, NR, WBF, PH, PR, Sens, WBF, WBN]
		Was measured, and is: [*enter the reading in the column to the right.*]	5.9	
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0	
		Neither of above. Enter "1".	0	
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):		See above for measurement guidance. [FR, INV, NRv, PH, PRv, Sens]
		TDS is: [*Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.*]	9	
		Conductivity is [*Enter the reading in µS/cm in the column to the right.*]	20	
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0	
		Neither of above	0	
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):		[FA, FR, PH, SBM, Sens, WBF, WBN]
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	
F50	Groundwater Strength of Evidence	Select first applicable choice:		Adhere to these criteria strictly -- do not use personal judgment based on fen conditions, pH, or other evidence. Consult topographic maps to detect breaks in slope described here. Rust deposits associated with groundwater seeps may be most noticeable as orange discoloration in ice formations along streams during early winter. [AM, CS, FA, FR, INV, NR, OE, PH, PRv, SFS, WC, WS]
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F51	Internal Gradient	The gradient along most of the flow path within the AA is:		This is not the same as the shoreline slope. It is the elevational difference between the AA's inlet and outlet, divided by the flow-distance between them and converted to percent. If available, use a clinometer to measure this. Free clinometer apps can be downloaded to smartphones. If the wetland is large (longer than ~1 km), this may be estimated using Google Earth to determine the minimum and maximum elevation within the AA, then dividing by length and multiplying by 100. [CS, NR, OE, PR, SR, WBF, WBN, WS]
		<2% or the AA has no surface water outlet (not even seasonally).	0	
		2-5%.	1	
		6-10%.	0	
		>10%.	0	
		Note for the next three questions: If the AA lacks an upland edge, evaluate based on the AA's entire perimeter, and moving outward into whatever areas are adjacent. In many situations, these questions are best answered by measuring from aerial images.		
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:		[AM, FA, FR, INV, NRv, PH, POL, PRv, SBM, Sens, SRv, STR, WBN]
		<5%.	0	
		5 to 30%.	0	
		30 to 60%.	0	
		60 to 90%.	1	
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):		[AM, FA, INV, NRv, PH, POL, SBM, STR, WBN]
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:		[NRv, PRv, Sens, SRv]
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	
		2-5%.	1	
		5-30%.	0	
		>30%.	0	
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	Do not include upturned trees as potential den sites. [POL, SBM]
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):		Determine this using historical aerial photography, old maps, soil maps, or permit files as available [CS, NR, OE, PH, Sens]
		No.	0	
		Yes, and created or expanded 20 - 100 years ago.	0	
		Yes, and created or expanded 3-20 years ago.	0	
		Yes, and created or expanded within last 3 years.	0	
		Yes, but time of origin or expansion unknown.	0	
		Unknown if new or expanded within 20 years or not.	1	
F57	Burn History	More than 1% of the AA's previously vegetated area:		Look for charred soil or stumps (in multiple widely-spaced locations) or ask landowner. [CS, PH, STR]
		Burned within past 5 years.	0	
		Burned 6-10 years ago.	0	
		Burned 11-30 years ago.	0	
		Burned >30 years ago, or no evidence of a burn and no data.	1	
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:		[PU, STR, WBFv]
		<25%.	0	
		25-50%.	0	
		>50%.	1	
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:		[PU, STR]
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: *[Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]*		[AM, FAv, FRv, PH, PU, SBM, STR, WBF, WBN]
		<5% and no inhabited building is within 100 m of the AA.	0	
		<5% and inhabited building is within 100 m of the AA.	0	
		5-50% and no inhabited building is within 100 m of the AA.	0	
		5-50% and inhabited building is within 100 m of the AA.	0	
		50-95%, with or without inhabited building nearby.	0	
		>95% of the AA with or without inhabited building nearby.	1	
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: *[See note above.]*		[AM, PH, PU, SBM, STR, WBF, WBN]
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	
		5-50%.	0	
		50-95%.	0	
		>95% of the AA.	0	

#	Indicators	Condition Choices	Data	Definitions/Explanations
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0	[PH, PU]
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0	[AM, PU, WBF, WBN]
F64	Consumptive Uses (Provisioning Services)	Recent evidence was found within the AA of the following potentially-sustainable consumptive uses. Select ALL that apply.		[FAv, FRv, WBFv]
		Low-impact commercial timber harvest (e.g., selective thinning).	0	
		Commercial or traditional-use harvesting of native plants, their fruits, or mushrooms.	0	
		Waterfowl hunting.	0	
		Fishing.	0	
		Trapping of furbearers.	0	
		None of the above.	1	
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:		[NRv]
		Within 0-100 m. of the AA.	0	
		100-500 m. away.	0	
		>500 m. away, or no information.	1	
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0	[PH, PR]

Investigator: Zacharye Simai	Site Identifier: WL-7-WM		Date: July 14, 2022	

Stressor (S) Data Form for Non-Tidal Wetlands. WESP-AC for Nova Scotia version 2.

	Item				Data
S1	Aberrant Timing of Water Inputs				
	In the last column, place a check mark next to any item that is likely to have caused the timing of water inputs (but not necessarily their volume) to shift by hours, days, or weeks, becoming either more muted (smaller or less frequent peaks spread over longer times, more temporal homogeneity of flow or water levels) or more flashy (larger or more frequent spikes but over shorter times). [FA, FR, INV, PH, STR]				
	Stormwater from impervious surfaces that drains directly to the wetland.				
	Water subsidies from wastewater effluent, septic system leakage, snow storage areas, or irrigation.				
	Regular removal of surface or groundwater for irrigation or other consumptive use.				
	Flow regulation in tributaries or water level regulation in adjoining water body, or other control structure at water entry points that regulates inflow to the wetland.				
	A dam, dike, levee, weir, berm, or fill -- within or downgradient from the wetland -- that interferes with surface or subsurface flow in/out of the AA (e.g., road fill, wellpads, pipelines).				1
	Excavation within the wetland, e.g., dugout, artificial pond, dead-end ditch.				
	Artificial drains or ditches in or near the wetland.				1
	Accelerated downcutting or channelization of an adjacent or internal channel (incised below the historical water table level).				
	Logging within the wetland.				1
	Subsidence or compaction of the wetland's substrate as a result of machinery, livestock, fire, drainage, or off road vehicles.				
	Straightening, ditching, dredging, and/or lining of tributary channels.				
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items had no measurable effect on the timing of water conditions in any part of the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Spatial extent of timing shift within the wetland:	>95% of wetland.	5-95% of wetland.	<5% of wetland.	2
	When most of the timing shift began:	<3 yrs ago.	3-9 yrs ago.	10-100 yrs ago.	1
	Score the following 2 rows only if the altered inputs began within past 10 years, and only for the part of the wetland that experiences those.				
	Input timing now vs. previously:	Shift of weeks.	Shift of days.	Shift of hours or minutes.	0
	Flashiness or muting:	Became very flashy or controlled.	Intermediate.	Became mildly flashy or controlled.	0
				Sum=	3
				Stressor subscore=	0.25
S2	Accelerated Inputs of Contaminants and/or Salts				
	In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of contaminants or salts to the AA. [AM, FA, PH, POL, STR]				
	Stormwater or wastewater effluent (including failing septic systems), landfills, industrial facilities.				
	Metals & chemical wastes from mining, shooting ranges, snow storage areas, oil/ gas extraction, other sources (download many locations from National Pollutant Release Inventory and view KMZ overlay in Google Earth. https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=B85A1846-1				
	Road salt.				
	Spraying of pesticides, as applied to lawns, croplands, roadsides, or other areas in the CA.				1
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly higher levels of contaminants and/or salts, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Usual toxicity of most toxic contaminants:	Industrial effluent, mining waste, unmanaged landfill.	Cropland, managed landfill, pipeline or transmission rights-of-way.	Low density residential.	2
	Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
	AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	1
				Sum=	4
				Stressor subscore=	0.44

Investigator: Zacharye Simai	Site Identifier: WL-7-WM		Date: July 14, 2022	

Stressor (S) Data Form for Non-Tidal Wetlands. WESP-AC for Nova Scotia version 2.

					Data
S3	Accelerated Inputs of Nutrients				
	In the last column, place a check mark next to any item -- occurring in either the wetland or its CA -- that is likely to have accelerated the inputs of nutrients to the wetland. [NRv, PRv, STR]				
	Stormwater or wastewater effluent (including failing septic systems), landfills.				
	Fertilizers applied to lawns, ag lands, or other areas in the CA.				
	Livestock, dogs.				
	Artificial drainage of upslope lands.				
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not cumulatively expose the AA to significantly more nutrients, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Type of loading:	High density of unmaintained septic, some types of industrial sources.	Moderate density septic, cropland, secondary wastewater treatment plant.	Livestock, pets, low density residential.	0
	Frequency & duration of input:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	0
	AA proximity to main sources (actual or potential):	0 - 15 m.	15-100 m. or in groundwater.	In more distant part of contributing area.	0
				Sum=	0
				Stressor subscore=	0.00
S4	Excessive Sediment Loading *from Contributing Area*				
	In the last column, place a check mark next to any item present in the CA that is likely to have elevated the load of waterborne or windborne sediment reaching the wetland from its CA. [FA, FR, INV, PH, SRv, STR]				
	Erosion from plowed fields, fill, timber harvest, dirt roads, vegetation clearing, fires.				1
	Erosion from construction, in-channel machinery in the CA.				
	Erosion from off-road vehicles in the CA.				1
	Erosion from livestock or foot traffic in the CA.				
	Stormwater or wastewater effluent.				
	Sediment from road sanding, gravel mining, other mining, oil/ gas extraction.				
	Accelerated channel downcutting or headcutting of tributaries due to altered land use.				1
	Other human-related disturbances within the CA.				
	If any items were checked above, then for each row of the table below, assign points (3, 2, or 1 as shown in header) in the last column. However, if you believe the checked items did not cumulatively add significantly more sediment or suspended solids to the AA, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Erosion in CA:	Extensive evidence, high intensity.*	Potentially (based on high-intensity* land use) or scattered evidence.	Potentially (based on low-intensity* land use) with little or no direct evidence.	2
	Recentness of significant soil disturbance in the CA:	Current & ongoing.	1-12 months ago.	>1 yr ago.	3
	Duration of sediment inputs to the wetland:	Frequent and year-round.	Frequent but mostly seasonal.	Infrequent & during high runoff events mainly.	1
	AA proximity to actual or potential sources:	0 - 15 m.	15-100 m.	In more distant part of contributing area.	3
	* high-intensity= extensive off-road vehicle use, plowing, grading, excavation, erosion with or without veg removal; low-intensity= veg removal only with little or no apparent erosion or disturbance of soil or sediment.			Sum=	9
				Stressor subscore=	0.75
S5	Soil or Sediment Alteration *Within the Assessment Area*				
	In the last column, place a check mark next to any item present in the wetland that is likely to have compacted, eroded, or otherwise altered the wetland's soil. Consider only items occurring within past 100 years or since wetland was created or restored (whichever is less). [CS, INV, NR, PH, SR, STR]				
	Compaction from machinery, off-road vehicles, livestock, or mountain bikes, especially during wetter periods.				
	Leveling or other grading not to the natural contour.				
	Tillage, plowing (but excluding disking for enhancement of native plants).				
	Fill or riprap, excluding small amounts of upland soils containing organic amendments (compost, etc.) or small amounts of topsoil imported from another wetland.				1
	Excavation.				
	Ditch cleaning or dredging in or adjacent to the wetland.				
	Boat traffic in or adjacent to the wetland and sufficient to cause shore erosion or stir bottom sediments.				
	Artificial water level or flow manipulations sufficient to cause erosion or stir bottom sediments.				
	If any items were checked above, then for each row of the table below, assign points. However, if you believe the checked items did not measurably alter the soil structure and/or topography, then leave the "0's" for the scores in the following rows. To estimate effects, contrast the current condition with the condition if the checked items never occurred or were no longer present.				
		Severe (3 points)	Medium (2 points)	Mild (1 point)	
	Spatial extent of altered soil:	>95% of wetland or >95% of its upland edge (if any).	5-95% of wetland or 5-95% of its upland edge (if any).	<5% of wetland and <5% of its upland edge (if any).	1
	Recentness of significant soil alteration in wetland:	Current & ongoing.	1-12 months ago.	>1 yr ago.	1
	Duration:	Long-lasting, minimal veg recovery.	Long-lasting but mostly revegetated.	Short-term, revegetated, not intense.	1
	Timing of soil alteration:	Frequent and year-round.	Frequent but mostly seasonal.	Mainly during one-time or scattered events.	1
				Sum=	4
				Stressor subscore=	0.33

Assessment Area (AA) Results:

Wetland ID: WL-7-WM

Date: July 14, 2022

Observer: Zacharye Simai

Latitude & Longitude (decimal degrees): 45.567734 -63.752673

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.44	Lower	5.53	Moderate	3.77	2.45
Stream Flow Support (SFS)	3.14	Moderate	9.84	Higher	2.53	6.55
Water Cooling (WC)	6.65	Higher	1.92	Lower	4.43	1.04
Sediment Retention & Stabilisation (SR)	3.78	Moderate	8.65	Higher	5.15	4.24
Phosphorus Retention (PR)	1.76	Lower	7.41	Higher	4.85	5.76
Nitrate Removal & Retention (NR)	3.06	Moderate	10.00	Higher	4.98	10.00
Carbon Sequestration (CS)	4.97	Moderate			7.55	
Organic Nutrient Export (OE)	9.62	Higher			6.29	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	7.41	Higher	2.48	Moderate	4.03	1.55
Aquatic Invertebrate Habitat (INV)	5.78	Higher	6.85	Higher	5.85	4.94
Amphibian & Turtle Habitat (AM)	4.72	Moderate	4.98	Moderate	5.60	5.87
Waterbird Feeding Habitat (WBF)	7.53	Higher	4.17	Moderate	5.74	4.17
Waterbird Nesting Habitat (WBN)	7.90	Higher	3.33	Moderate	5.73	3.33
Songbird, Raptor, & Mammal Habitat (SBM)	9.80	Higher	10.00	Higher	8.53	10.00
Pollinator Habitat (POL)	8.68	Higher	3.33	Moderate	7.19	3.33
Native Plant Habitat (PH)	6.14	Moderate	6.35	Moderate	6.35	6.35
Public Use & Recognition (PU)			4.13	Moderate		3.13
Wetland Sensitivity (Sens)			9.04	Higher		4.75
Wetland Ecological Condition (EC)			8.26	Higher		9.17
Wetland Stressors (STR) (higher score means more stress)			7.78	Higher		3.92
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.44	Lower	5.53	Moderate	3.77	2.45
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	4.18	Moderate	9.34	Higher	6.59	8.33
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.96	Higher	8.02	Higher	5.53	5.36
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.71	Higher	3.99	Moderate	4.98	4.42
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	9.00	Higher	8.28	Moderate	7.94	8.28
WETLAND CONDITION (EC)			8.26	Higher		9.17
WETLAND RISK (average of Sensitivity & Stressors)			8.41	Higher		4.33

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	13.48099053	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	39.04601259	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	63.84206434	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	26.73213723	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	74.53867211	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Water Storage & Delay		The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	WS					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	If a wetland is capable of storing runoff, its positive effect on controlling downslope flood peaks is greater if it is large relative to the volume of runoff it receives, which is reflected somewhat by the extent of its contributing area. Wetlands that comprise a large portion of their contributing area have a greater potential to control the runoff arriving from that lmited area.	CApct1
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.67	North-facing slopes are likely to remain frozen for longer periods, thus limiting the soil's capacity to store or infiltrate runoff.	Aspect1
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	0	3	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	2	2			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	The longer the hydrologic path length, the greater the friction provided and thus the most effective a wetland potentially is at slowing or desynchonizing the downslope movement of runoff.	FloDist1
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer parts of the region imply a longer period of time during which the ground remains unfrozen and during which vegetation can potentially remove water via evapotranspiration.	_GDD1
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.67	Large variation in elevations within a wetland, both at a micro- (~1 m) and macro (>10m) scale, suggest greater potential for trapping and retaining snow and other precipitation sufficiently long to allow runoff to infiltrate or evaporate from the wetland and thus delay or avoid its entry into downslope rivers (Kadlec et al. 1981, Price et al. 1990).	Girreg1
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	1	0			
		Intermediate.	1	2	2			
		Several (extensive micro-topography).	0	3	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.80	Considerable amounts of water can be stored below the land surface in peat and coarse-textured substrates. However, very little new runoff can be stored if the substrates are already saturated. Peat tends to be saturated much of the time, and groundwater discharge dominates many wetlands with coarse-textured substrate, keeping those saturated much of the time and thus limiting the capacity to store additional water. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water. Runoff ratio is greatest in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Quinton et al. 2003, Emili & Price 2006).	SoilTex
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	1	4	4			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	This directly estimates the relative amount of horizontal space in which precipitation and runoff are being stored, at least temporarily. The ability of wetland water storage to reduce stream peak flows is greatest in summer and fall, where those are the driest times of year (Roulet & Woo 1988, Quinton & Roulet 1998). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	This directly estimates the relative amount of vertical space in which precipitation and runoff are being stored, at least temporarily. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fluctua
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding indicates water is in storage rather than being transferred immediately downslope. Water distributed in small pools is more subject to loss via evapotranspiration before it can exit a wetland, and this delay can measurably reduce peak outflows (Price & Maloney 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	0	0			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.33	Wetlands that store water only temporarily or seasonally have longer periods during the year in which soils are unsaturated and thus able to briefly store or delay additional water from precipitation and runoff. Wetland connectivity is key to estimating wetland water storage: wetlands that lack an outlet (never have any outflow) store or dissipate (via evaporation or seepage) nearly all the water they receive (Spence et al. 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura
		Persistent (surface water flows out for >9 months/year).	0	1	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus increasing storage (Carter et al. 1979). The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	3	3			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	0	2	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.38	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the outflow and downstream movement of water (Price & Woo 1988). This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods), and is tall and stiff enough to provide some resistance (Arcement & Schneider 1989). However, woody vegetation itself occupies space otherwise available for storing water (this effect is usually negligible). Water also takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. Also is excluded automatically if no surface inflow.*	ThruFlo
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	3	3			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	4	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	6	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands fed constantly by groundwater are likely to have only limited subsurface storage space for storing additional precipitation. However, they may remain unfrozen for longer periods. *In calculations, is excluded automatically (cell goes blank) if no strong evidence of groundwater (last choice).*	Groundw
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	1	0			
		Most of the AA has a slope of >5% , or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	3	3			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.60	Sloping wetlands retain surface runoff and precipitation for shorter times.	Gradient
		<2% or the AA has no surface water outlet (not even seasonally).	0	5	0			
		2-5% .	1	3	3			
		6-10% .	0	2	0			
		>10% .	0	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF17	Flood Damage from Non-tidal Waters	Within 5 km downstream or downslope of the AA (select first true choice):				0.00	Storage by wetlands is obviously more valuable when properties located downslope might otherwise be flooded. The need for (and value of) storage potentially provided by wetlands is greater when floodable property downslope is not being adequately protected by other water storage or detention features.	FloodBdg
		Maps show Flood Zone or Flood Risk areas and there appears to be infrastructure vulnerable to river flooding not caused by tidal storm surges.	0	4	0			
		Maps show Flood Zone or Flood Risk areas, but infrastructure is absent or is not vulnerable to floods from a non-tidal river. In some cases levees, upriver dams, or other measures may partly limit damage or risk from smaller events.	0	1	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there appears to be infrastructure vulnerable to river flooding unrelated to tidal storm surges.	0	2	0			
		Maps do not show Flood Zone or Flood Risk areas (or no such mapping has been done locally) and there is no infrastructure vulnerable to river flooding unrelated to tidal storm surges.	1	0	0			
OF23	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.98	Wetlands that store floodwater are more valuable if they are in the headwaters of a watershed, placing them above areas which might otherwise be damaged by floods.	ShedPos1
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) storage potentially provided by wetlands is greater when upland runoff is rapid, as occurs when much of the contributing area contains impervious surface (Laenen 1980, Waite et al. 2006). In contributing areas with extensive impervious surface, the proportion of stream flow due to surface runoff can be as much as five times that seen in forested catchments (Arnold & Gibbons 1996). The increase in surface runoff due to urbanization is especially greater in the Pacific Northwest due the naturally high infiltration capacity of the soils and the low intensity of the rainfall, which makes surface runoff a rare phenomenon in undeveloped watersheds (Booth & Jackson 1997). Increased surface runoff causes a shortening of the lag time between precipitation and stream flow response (Hirsch et al. 1990). The effect is higher peak flows but of shorter duration than those in forested catchments receiving comparable rainfall (Leopold 1968). *In calculations, is ignored (cell goes blank) if wetland appears to have no contributing area.*	CAunveg
		<10% .	1	0	0			
		10 to 25% .	0	3	0			
		>25% .	0	4	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00		Transport
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			

Subsurface Storage (Infiltration Capacity & ET)	0.65	[3*AVERAGE(SoilTex , Groundw, CApct) + AVERAGE(GDD, Aspect)] /4	Subsurf
Live Store	0.33	IF((AllSat1=1), blank, AVERAGE(Fluctua, SeasPct))	LiveStore
Friction	0.50	IF((AllSat1=1), (3*Gradient +AVERAGE(Gcover, Girreg))/4, ELSE: AVERAGE(Gradient, Constric, ThruFlo, FloDist, IsoDry)	Friction

Function Score for Water Storage	F	3.77	IF((AllSat1=1), AVERAGE [(OutDura, AVERAGE(Subsurface, Friction)], ELSE: AVERAGE [OutDura, (4*LiveStore + 2*Friction + Subsurf)/7))]
Benefits Score for Water Storage	B	2.45	IF((FloodBdg=1), 1, AVERAGE(FloodBdg, AVERAGE: (ShedPos, CAunveg, Transport))

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Stream Flow Support	The effectiveness for extending flow duration into drier parts of a growing season.	SFS						
#	**Function Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	Snow tends to accumulate more on north-facing slopes due to less sun exposure, and water losses from evapotranspiration are less. Consequently, streamflow fed by such slopes may persist longer into drier periods.	Aspect2_
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	0	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				1.00	Many or most fens are groundwater discharge areas (Siegel & Glaser 1987), and such discharge is more seasonally stable and thus more likely to contribute water late in the season when streamflow otherwise can be low. Some bogs, especially those that have outlets, discharge groundwater and thus potentially influence low flows (Siegal 1988). Where located near the Maritime coast, they lose relatively little water to evaporation and infiltration (Price 1992). Much of their water is released later in the spring and summer than in other wetland types, due to its remaining frozen later on account of the insulating effects of peat (Price & Maloney 1994). Water tables in riparian swamps and marshes typically fluctuate with river levels, and so are less likely to contribute much water during low flow conditions.	Wettype2
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	3	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	4	4			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.80	Peat soils retain water for longer periods than coarse mineral soils, and the deeper the better. Subsurface ice which helps sustain streamflow also may remain longer into the late spring in peatlands due to the insulating effects of peat. Runoff ratio (the percent of precipitation that contributes to streamflow immediately after storms) is lowest for open peatland areas with thick organic horizons (0.02-0.05) due to low topographic gradients and many surface depressions capable of retaining surface water (Wiley & Curran 2003). Runoff ratio is greatest (surface water retention is least) in areas with more permeable soils, at least where those areas aren't sloping. That is due partly to higher likelihood of groundwater reaching the land surface via seeps (Emili & Price 2006)	Soil2_
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	1	4	4			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Deeper water implies greater water volume to potentially feed downslope streams. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth2_
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	3	0			
		>2 m deep. True for many fringe wetlands.	0	4	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.50	This is the primary indicator of a wetland's potential for supporting summer flow in connected downslope streams.	OutDur2_
		Persistent (surface water flows out for >9 months/year).	0	6	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	3	3			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Wetlands fed by groundwater tend to remain saturated for longer in the summer, thus increasing their chances of supporting streamflow downslope (Burrell & Anderson 1991, Morley et al. 2011). Wetlands are typically ground water discharge areas where they occur at the toe of much steeper slopes (Crabtree & Burt 1983) or at geologic faults (Stein et al. 2004).	Groundw2_
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.98	Wetlands that contribute to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow that is affected by wetlands there is likely to be greater than in lowlands.	ShedPos2
	Function Scores	Function Score for Invertebrates				0.59	Summer streamflow is critical to supporting this group's productivity and diversity.	InvScore2
		Function Score for Anadromous Fish Habitat				0.00	Summer streamflow is critical to supporting this group's productivity and diversity.	AnadScore2
		Function Score for Non-anadromous Fish Habitat				0.40	Summer streamflow is critical to supporting this group's productivity and diversity.	ResFish Score2

Connectivity	0.50	OutDur	ConnectivLF
Surface Storage	0.52	AVERAGE(Aspect, Depth, Soil)	ClimateLF
Groundwater Input	0.50	AVERAGE(Groundw, Wettype)	GpC_2

Function Score for Low Flow Augmentation	F	2.53	OutDur * [(2*GroundwaterInput + SurfaceStorage)/ 3]
Benefits Score for Low Flow Augmentation	B	6.55	AVERAGE[ShedPos, AVERAGE(InvScore, AnadScore, ResFishScore)]

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Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	WC

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	North-facing wetlands are likely to be more shaded and thus cooler and more capable of contributing cool water to downslope water bodies.	Aspect7
		Northward (N, NE). north-facing contributing area.	0	2	0			
		Southward (S, SW). south-facing contributing area.	0	0	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.80	When water remains entirely belowground, water temperatures in summer remain cooler than if exposed aboveground.	SatPct7
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	4	4			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				0.25	Shade from vegetation and other features is an important factor in cooling surface water and runoff before it reaches water bodies farther downstream (e.g., Rounds 2007). A study of many Seattle-area wetlands found that summertime temperatures ranged higher in wetlands that were characterised by relatively large open pools that lacked shade (Reinelt & Horner 1990). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if water is present only seasonally.	Shade7
		<5% of the water is shaded, or no surface water is present then.	0	0	0			
		5-25% of the water is shaded.	1	1	1			
		25-50% of the water is shaded.	0	2	0			
		50-75% of the water is shaded.	0	3	0			
		>75% of the water is shaded.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.17	Wetlands with greater water depth overall tend to have cooler outflows (depending on elevation of the outlet) because water depth provides insulation from solar warming. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth7
		<10 cm deep (but >0).	0	0	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	6	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Where most of the surface water is ponded, it is more likely to be heated by the sun than if distributed in the channels or residing underground. *This indicator is used only if some persistent surface water is present in the AA. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry7
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Ponded water that is open and unvegetated it is more likely to be heated by the sun. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	OpenPonded
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater discharging into wetlands supports a wetland's capacity to cool surface runoff during summer, because groundwater in most cases is cooler than surface water during that time (Mellina et al. 2002). In this region, cooler stream temperatures are associated with a greater proportion of groundwater-discharging wetlands in stream headwaters (Monk et al. 2013).	Gwater7
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.98	Wetlands that contribute cooler water to stream flow are more valuable if they are in the headwaters of a watershed, because small and intermittent streams are most likely to be prevalent there, and the proportion of their base flow (and thus their temperature) that is affected by wetlands there is likely to be greater than in	ShedPos7
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need to cool surface waters is likely to be greatest at locations where much of the contributing area is clearcut or paved, thus generating warmer inputs to streams.	Imperv7
		<10%.	1	0	0			
		10 to 25%.	0	2	0			
		>25%.	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	The need to cool surface waters is likely to be greatest where streams are south-facing and thus are exposed longer each day to warming sunlight. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its apparent contributing area.*	Aspect7v
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	0	2	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	The need to cool surface waters is likely to be greatest at locations that are the region's warmest.	Warmth7
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Wetlands that are narrower than the channel, lake, or estuary they adjoin are likely to have much less effect on water temperature in those receiving waters.	Fringe7b
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.40	Wetlands that have no outflow are likely to have only minimal effect on temperature of other water bodies.	OutDur7
		Persistent (surface water flows out for >9 months/year).	0	5	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F45	Input Water Temperature	Based on lack of shade, water source characteristics, or actual temperature measurements, the inflow is likely to be warmer than surface water in the AA during part of most years. Enter 1= yes, 0= no.	1			1.00	Unshaded input streams provide more opportunity for wetlands to cool the water. Streams whose contributing areas have a greater extent of roads (road density) have higher temperatures. A study of 104 streams in British Columbia found there is a 6-in-10 chance that the summer maximum weekly average water temperature will increase by 2.3 degrees F if road density in the contributing area exceeds 27 ft of road per acre and by 5.8 degrees F if road density exceeds 53 ft of road per acre (Nelitz et al. 2007). However, overall vegetation patterns in a watershed frequently have an equal or greater influence on stream temperature and aquatic productivity than vegetation just within buffer areas adjoining a stream (Brosofske et al. 1997, Sridhar et al. 2004, Stephenson & Morin 2009). One study found that maximum air temperature within a 100-ft wooded buffer was only slightly cooler than in a 16-ft wide wooded buffer (Meleason & Quinn 2004). Vegetated buffers along north-south streams in British Columbia are more effective than those oriented east-west (Gomi et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland has no input tributary.*	ShadeIn7
	Function Score for Anadromous Fish					0.00	Anadromous fish in this region are highly sensitive to warm temperatures, so wetlands that cool or maintain natural water temperatures could be considered more valuable.	AnadFish7

Function Score for Water Cooling	F	4.43	IF((AllSat1=1), Gwater, ELSE: AVERAGE(Gwater, Shade, OpenPonded, Depth, ISOdry, SatPct)))
Benefit Score for Water Cooling	B	1.04	IF(Fringe=1), 0, OutDur X [AVERAGE(ShadeIn, ShedPos, Aspect, Imperv, Warmth) + AnadFish] /2

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Sediment Retention & Stabilisation	The effectiveness for intercepting and filtering suspended inorganic sediments, thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilising underlying sediments or soil.	SR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981). Here, wetland area is used as a surrogate for wetland volume.	WetPctCA2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate area.	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Longer flow paths within a wetland allow more time and opportunity for suspended sediments to be deposited.	FlowDist2
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, and thus deposition of sediment suspended in runoff, is potentially greater in areas where water and soils do not remain frozen for long periods. Wetlands tend to be ice-covered for shorter duration, thus reducing the erosion of sediment from their shorelines as a result of ice scour. Mean annual temperature is one indicator of the likelihood of this condition.	GDD2
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to water flow, promoting sedimentation of suspended particles, as well as reducing the resuspension of bottom sediments by waves and currents.	Gcover2
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	5	5			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	2	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	These features cumulatively decelerate runoff, thus allowing for more sedimentation to occur, although usually only to a minor degree.	Girreg2
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	As a wetland's surface water area expands seasonally, water velocity is often reduced due to increased friction, and material suspended in the expanding water body is more likely to be deposited. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct2
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.50	Suspended sediment is more likely to be filtered and stranded in vegetation if water levels fluctuate. However, in some soil types, large water level fluctuations cause erosion that results in more sediment being exported than retained. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if surface water is permanent (i.e., must have at least a seasonal-only zone in order to have water fluctuation).*	Fluc2
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper waters usually imply slower water velocity, longer water detention time, more space for storing deposited sediments over time, and reduced likelihood of deposited sediments being resuspended by wind mixing or currents (Evans & Rigler 1983, Nolen et al. 1985). However, vegetation density is usually greater in shallow wetlands, providing other opportunities to filter and stabilize (with roots systems) suspended sediments. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthC2
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponding allows more time for suspended sediment to settle out. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Ponding2
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					As the proportionate area of emergent and other aquatic plants increases, current velocity may be reduced (depending on the distribution of the plants relative to flow paths), and a larger proportion of the sediment may be intercepted, particularly if the wetland is not narrow. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov2
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.57	Wider vegetated areas provide more area for sediment particles borne in runoff to be filtered and deposited. Knutson et al. (1981) found that emergent wetlands wider than 30 feet reduced wave energy by 88% while those less than 6 feet wide were relatively ineffective in wave buffering. Many studies have shown that sediment retention is greatest in the first 5-20 ft of a buffer, that is, the most uphill portion, which is closest to potential inputs of runoff-borne sediment (Polyakov et al. 2005, White et al. 2007). However, this depends on steepness of the terrain, erodibility and infiltration capacity of the soil, ground cover, antecedent soil saturation, sediment particle size, and runoff intensity. Wider buffers are required when runoff carries finer-sized particles (e.g., clay). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthAbs2
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	4	4			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	Wetlands whose shorelines have gentle slope are more likely than those with steep ones to retain sediment runoff from adjoining uplands, and are likely to have more vegetation that facilitates this. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	WatEdge Slope2
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation should allow more contact between plants and moving sediment-bearing water, resulting in greater deposition of suspended sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if there is no ponded water, or if ponded water but no vegetation, or if ponded but no open water.*	Interspers2
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.33	Wetlands that lack outlets retain all sediment that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less sediment annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDur2
		Persistent (surface water flows out for >9 months/year).	0	1	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for suspended sediments to be deposited. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of sediment (Amatya et al. 2003). *In calculations, is excluded automatically (cell goes blank) if no outlet. In calculations, is excluded automatically (cell goes blank) if wetland has no surface water outlet.*	Constric2
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	2	2			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	0	1	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.38	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus sedimentation, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment to be deposited. The sinuosity is as much the result of sedimentation-erosion dynamics as it is the cause of them. Wetlands with a sheet flow pattern often retain more suspended solids than channelised systems because interception and resistance is greater (Morris et al. 1981). In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.	ThruFlo2
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	3	3			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	6	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	4	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	8	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50		Gradient2
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	If soil or sediment within a wetland is eroding, the wetland is unlikely to be trapping incoming suspended sediment. *In calculations, is ignored (cell goes blank) if wetland soil is currently intact, but is scored as a negative if disturbance is occurring.*	

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive sediment from upslope is entering a wetland, this provides more opportunity for the wetland to trap sediment and associated metals and hydrocarbons. This increases the value of any retention capacity that the wetland provides. High levels of incoming suspended sediment often correspond with high levels of other pollutants.	ToxUp2
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	ToxData2
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Wetlands with large contributing areas are likely to receive more suspended sediment and thus have more opportunity to trap sediment, which potentially increases their value as protectors of downstream water quality.	CApct2
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) sediment-trapping capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, as occurs when much of the contributing area contains unvegetated surface. However, a study in Alaska that compared total sediment yield in channels surrounded by old-growth, clear cut, and young alder found no significant difference in sediment yield (Gomi & Sidle 2003). In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.	ImpervPctSS
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) sediment retention that potentially could be provided by wetlands is greater when upland sediment loads are not being retained or rerouted by features closer to the sediment source. If runoff is diverted away from downslope wetlands, such as in road ditches or drainage tile, then those wetlands will become drier. When they do, they will have less opportunity to receive water with suspended solids (Wigington et al. 2005, Hogan & Walbridge 2007). Even when runoff is not diverted from the wetlands, if the volume of runoff entering a wetland per unit time increases, the wetland will be less effective in treating the runoff. That is because increased runoff will often cause tiny channels to develop within the wetland, or will increase the dimensions of existing ones. These factors will decrease the detention time and pollutant contact with vegetation, because most of the vegetation will be positioned apart from the water flowing through in the small channels (McBride & Booth 2005, Alberti et al. 2007). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	TransportSS
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.00	There is more opportunity for suspended sediments to be trapped by a wetland (and thus more value to this function) if the wetland contains surface water which facilitates transport of suspended sediment. into the wetland.	SatPct2
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	6	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	2				
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Large water level fluctuations pose the possibility of increased shoreline erosion, which can be partly alleviated by wetlands, thus making those wetlands more valuable as shoreline stabilizers.	MaxFluc2
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Used as a classifier.	Inflo2
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.25	Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of sediment. Their sediment-trapping role could thus be considered to be more essential and valuable than if vegetated buffers were adequate to perform the same function.	CAnatPct2
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	0	2	0			
		60 to 90%.	1	1	1			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.17	Increased slope in a watershed or buffer strip results in more erosion and greater transport of soil particles to downslope wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), and Nieswand et al. (1990). Sediment export from sloping lands mostly begins at about 10% slope and increases as slope becomes steeper (Zhang et al. 2010). Greater sediment loads associated with steeper slopes increase the opportunity for wetlands to trap that sediment, thus increasing their value in protecting waters further downslope. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area or the last choice was selected in the previous question.*	BuffSlope2
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	1	1	1			
		5-30%.	0	4	0			
		>30%.	0	6	0			
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.75			0.75	Because actual data on sediment loads are lacking for many wetland watersheds, this approximation is included as well, and is based on a host of activities known in some cases to contribute excessive sediment, e.g., wetland ditching (Pavey et al. 2007).	Erodible2

Live Store	0.38	IF(AllSat1=1),"", AVERAGE(Fluctua, SeasPct)	LiveStore2
Entrain	0.54	IF(AllSat1=1),"", AVERAGE(OutDura, FlowDist, Depth, Ponding, Constric, WatEdgeSlope)	Entrain
Dry Intercept	0.63	AVERAGE[Gradient, WetPctCA, AVERAGE(Girreg, Gcover, SoilDisturb)]	DryIntercept
Wet Intercept		IF(AllSat1=1),"", IF(NoPonded=1),"", ELSE: AVERAGE (Width, AVERAGE(GDD, Thruflo, AqPlantCov, Interspers))	WetIntercept

Function Score for Sediment Retention & Stabilization	F	5.15	(IF((AllSat1=1), DryIntercept, IF((NoOutlet=1), 1, (2*AVERAGE(Entrain, LiveStore2) + AVERAGE(DryIntercept, WetIntercept))/3)))
Benefits Score for Sediment Retention & Stabilization	B	4.24	MAX(ToxData, ToxUp, AVERAGE(Inflo, SatPct, AVERAGE(ImpervPctSS, ErodibleSS, CAnatPct, BuffSlope, CApct, TransportSS, MaxFluc)

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Phosphorus Retention	The effectiveness for retaining phosphorus for long periods (>1 growing season) as a result of chemical adsorption, or from translocation by plants to belowground zones with less potential for physically or chemically remobilizing phosphorus into the water column.	PR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Sediment deposition (and P-retention, which sometimes correlates with that) increases as the ratio of the volume of a storage basin (e.g., wetland) to the volume of runoff entering the basin from its contributing area increases (Heinemann 1981).	CApctB3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.50	Phosphorus retention often correlates with detention time, which in turn correlates with flow path length within a wetland.	FlowDist3
		<10 m.	0	0	0			
		10 - 50 m.	0	1	0			
		50 - 100 m.	0	2	0			
		100 - 1000 m.	1	3	3			
		1- 2 km.	0	4	0			
		>2 km, or wetland lacks an inlet and outlet.	0	6	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Infiltration, which enhances deposition of sediment-bound P, is potentially greater in areas where water and soils do not remain frozen for long periods. However, cold temperatures slow the decomposition of plant material and increase the retention of P in accumulating peat.	GDD3
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to runoff, promoting sedimentation of suspended particles and reducing erosion. This promotes phosphorus retention because phosphorus is typically adsorbed to soil particles.	Gcover3
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	These features cumulatively decelerate runoff, thus allowing for more deposition of phosphorus-containing suspended sediments to occur, although usually only to a minor degree.	Girreg3
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.80	Long-term retention of phosphorus can occur when soil or sediment contains high concentrations of aluminum or iron, mainly at low pH (Richardson et al. 1985), and to a lesser extent, calcium at higher pH (Bridgham et al. 1996). Aluminum occurs most commonly in organic and clay soils. Phosphorus is also retained in wetlands via plant uptake, but in organic soils, acidic conditions can inhibit plant capacity to take up and retain phosphorus (Prescott et al. 2000) and in most cases, this represents only a temporary retention..	SoilTex3
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Deep Peat, to 40 cm depth or greater.	0	5	0			
		Shallow Peat or organic <40 cm deep.	1	4	4			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Lacustrine wetlands are more likely than bogs or fens to be phosphorus-limited (Walbridge & Navaratnam 2006), and thus should be more able to take up and retain	Lake3
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.80	Sites that remain continually moist (saturated) but not flooded may be more likely to retain phosphorus (Aldous et al. 2007).	SatPct3
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	4	4			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	In some cases, sediments that remain covered with water year-round (and longer) tend to become anaerobic and release phosphorus, especially in deeper wetlands. Thus, wetlands with the least extent of persistent water may be most retentive of whatever P they receive. On the other hand, seasonal drawdowns can mobilize phosphorus that has accumulated in sediments (Snyder & Morace 1997, Aldous et al. 2005). To a perhaps lesser extent, reflooding of soils that have been dry for extended periods also can mobilize phosphorus, especially if flooding creates anoxic conditions (Burley et al. 2001), or if large quantities of leaf litter and other organic matter are present and rapidly decompose or leach phosphorus. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Persis3
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Wetting and drying of sediments, as happens especially in wetlands with large water level fluctuations, increases the leaching and desorption of phosphorus from sediment organic matter, thus resulting in net export. However, stable water levels also can promote phosphorus export (not retention) because they are often associated with anoxic conditions that result in increased mobility of phosphorus. Sediment P release and subsequent export is particularly strong during periods of seasonal anoxia (Burley et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu3
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.40	Deeper wetlands are more likely to experience anoxic conditions that promote P mobility and export. However, deeper waters also imply slower water velocity, longer water detention time, more time for biological processing of phosphorus, and reduced likelihood of phosphorus associated with deposited sediments being resuspended by wind mixing or currents. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DomDepth3
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	5	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up phosphorus from sediments (and some, from the water directly) and can facilitate long-term retention if P is transferred to roots that are not as subject as the foliage is to leaching the nutrients back into the water column. Plants also facilitate sediment deposition by slowing the water, and much phosphorus is adsorbed on that sediment so is also deposited and potentially retained. However, their decaying foliage also frequently creates anoxic conditions that promote P release from sediments, if iron concentrations are low and aeration by currents and wind is poor (as tends to occur when emergent and submersed aquatic plants occupy most of a water body). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov3
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	4	0			
		70-99% of the ponded water.	0	3	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.57	Wider vegetated areas provide more area for phosphorus adsorbed to sediment particles in runoff to be filtered and deposited. Where phosphorus is mainly attached to sediment (as often it is), then buffer widths sufficient for sediment retention (generally 10-30 ft) may be almost as effective for retaining phosphorus (White et al. 2007). But if phosphorus is mostly in dissolved form (orthophosphate, or soluble reactive phosphorus), then vegetated buffers may need to be very large or may not be effective at all (Prepas et al. 2001, Hoffman et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VegWabs3
		<1 m.	0	0	0			
		1 - 9 m.	0	2	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	4	4			
		50 - 100 m.	0	5	0			
		> 100 m, or open water is absent at that time.	0	7	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater sediment and phosphorus removal. That is because plants assist the deposition of suspended sediment which contains P, while open water areas tend to be more aerobic which immobilizes P in the deposited sediment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, or if ponded but no open water.*	Interspers3
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				A proliferation of algae and floating aquatics can indicate that the wetland is receiving more nutrients than it is capable of processing effectively. These non-rooted plants do not oxygenate the sediments, they take up and store nutrients only briefly, and their die-offs create anoxic conditions that mobilize phosphorus temporarily retained in sediments. In the calculations, abundant algae reduces the score but absence of blooms does not increase it. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Algae3
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.33	Wetlands that lack outlets retain all phosphorus that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less phosphorus annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura3
		Persistent (surface water flows out for >9 months/year).	0	1	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for sediments to be deposited and phosphorus to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. A restricting outlet in wetlands can reduce export of phosphorus (Amatya et al. 2003).	Constric3
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	2	2			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	0	1	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.25	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow phosphorus adsorbed to sediment particles to be deposited. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Although tall and stiff vegetation provides the most resistance and thus may be more effective at allowing sediment to be deposited, it often tends to have less ground cover, so the net effect is uncertain in some wetlands. Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the phosphorus associated with it to be deposited. Wetlands with a sheet flow pattern often retain more total phosphorus than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo3
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:					Acidic conditions (indicated by staining) potentially support greater adsorption of P by iron and aluminum (Richardson et al. 1996, Sutmm & Morgan 1996) and that is often associated with the dissolved organics that cause staining (Gorham et al. 1998). Acidic conditions also slow the decomposition of plant material, thus increasing P storage in peat. P retention can also occur at high pH as a result of precipitation with calcium. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. Otherwise, retention is assumed to increase below a pH of 5 or above a pH of 9.*	Stain3
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.75	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the phosphorus that is associated with it. Ground cover becomes more important to sediment stabilization in wetlands on slopes.	Gradient3
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	3	3			
		6-10%.	0	2	0			
		>10%.	0	0	0			
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0			0.00	P retention is expected to be considerable in calcareous fens because soluble P is precipitated by calcium when pH is basic, and those conditions typify calcareous fens..	CalcFen3

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardize	Rationales	Cell Name
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive phosphorus from upslope is entering a wetland, this provides more opportunity for the wetland to retain P and thus increases the value of any P-retention that the wetland provides. High P levels often correspond with high levels of other pollutants.	PsampUp3
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	PsampDown3
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	Phosphorus commonly adsorbs to suspended sediment, and wetlands that comprise a large proportion of their contributing area are more effective for retaining sediment in runoff, and thus phosphorus.	CApct3
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) phosphorus retention capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and associated P. This occurs when much of the contributing area contains impervious surface. Other factors being equal, wetlands in developed watersheds (with little remaining natural cover) tend to receive higher loads of phosphorus. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 40% more phosphorus to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009). *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	ImpervCA3
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) phosphorus retention that potentially could be provided by wetlands is greater when upland phosphorus loads are not being retained by features closer to the phosphorus source. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	Transport3
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of sediment and adsorbed phosphorus, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflo3
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of P are commonly associated with higher levels of conductivity and TDS. Higher P concentrations indicate more opportunity for the wetland to retain P, thus making its provision of this service more valuable to downstream waters. In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. In calculations, is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.	Conduc3
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater in many areas is phosphorus-rich, especially when associated with iron-rich bedrock. This increases the opportunity of the receiving wetlands to process the P, thus increasing the importance (value) of their role in the local ecosystem.	Groundw3
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.25	Riparian buffers (in contrast to vegetation and other features located far from streams) can be responsible for up to 70% of the reduction in nutrient loads to streams (Diebel et al. 2009, Roberts & Prince 2010), so a lack of an adequate buffer increases the opportunity (and thus value) for a wetland to process nutrients.. However, many factors other than buffers control a wetland's water quality. These include underlying soils and geology, groundwater discharge or recharge rates, topography, plants and animals within a wetland, and proximity to the ocean (Feller 2005).	NatCApct3
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	0	2	0			
		60 to 90%.	1	1	1			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.33	Wetlands that receive suspended sediment in runoff from steep slopes are more likely to retain it because of the large differential in current velocities, which promotes deposition in the wetland. This increases the opportunity of the wetlands to process the P, thus increasing the importance (value) of their role in protecting downslope waters from overenrichment. *In calculations, is excluded automatically (cell goes blank) if wetland is larger than its contributing area.*	BuffSlope3
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	1	1	1			
		5-30%.	0	2	0			
		>30%.	0	3	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	0			0.00	Because actual data on phosphorus loads are lacking for many wetland watersheds, this approximation based on a host of phosphorus-generating activities is included as well.	Pload3

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
			Frozen Duration			0.13	GDD	FreezeDura3
			Intercept Dry			0.66	AVERAGE(Gradient, FlowDist, AVERAGE(Girreg, Gcover, CApctB))	IntercepDry3
			Intercept Wet				IF(AllSat1=1),"", IF(NoPonded=1),"", AVERAGE (Width, MAX(Thruflo, AqPlantCov, Interspers))	IntercepWet3
			Connectivity			0.52	AVERAGE(OutDur, Constric, Gradient, FlowDist, Lake)	Connec3
			Adsorption			0.40	AVERAGE(SoilTex, Stain, CalcFen)	Adsorb3
			Desorption			0.65	AVERAGE(SatPct, Persis, DomDepth, Fluctu)	Desorb3

Function Score for Phosphorus Retention	F	4.85	IF((AllSat1=1), AVERAGE(IntercepDry, Adsorb, FreezeDura), IF((NoOut=1), 1, ELSE: (3*AVERAGE(Adsorption, Desorption) + 2*Connectivity+ (AVERAGE(InterceptWet, InterceptDry) + FreezeDuration) / 7
Benefits Score for Phosphorus Retention	B	5.76	[MAX(Pload, PsampUp, PsampDown, AVERAGE((Inflo, AVERAGE(BuffSlope, CApct, Transport, Groundw, ImpervCA, NatCApct))

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Nitrate Removal & Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas, primarily through the microbial process of denitrification, while generating little or no nitrous oxide (a potent greenhouse gas).	NR

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF16	Upland Edge Contact	Select one:				1.00	Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, proportionally longer (i.e., convoluted) edges should provide the most opportunity for removal of nitrate via denitrification.	UpEdge Shape4
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	1	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	4	4			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.98	A disproportionate amount of the nitrate introduced to a watershed is processed in headwater areas rather than in downstream lowland areas (Krause 1982). However, where headwaters are at regionally high altitudes, the cooler temperatures and shorter growing seasons can potentially restrain denitrification.	Elev4
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	Where a wetland comprises a large proportion of its catchment, nutrient loading is more likely to occur at rates and levels that can be processed effectively.	WetPctCA4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.50	Soil temperatures are warmer for longer on south-facing slopes, and this is essential for denitrification which removes soluble N (Kim et al. 2007). However, those soils should not be dried out to less than 70% saturation by those warmer conditions (Hefting et al. 2006).	Aspect4
		Northward (N, NE). north-facing contributing area.	0	0	0			
		Southward (S, SW). south-facing contributing area.	0	2	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	1	1			
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	N removal often correlates with detention time, which in turn correlates with flow path length within a wetland.	FloDist4
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Microbes responsible for most of the nitrate removal in wetlands thrive best at warmer soil or sediment temperatures. In contrast, freeze-thaw cycles in wetlands are often characterized by change from aerobic to anaerobic conditions, which can mobilize nitrate in sediments, making the nitrate vulnerable to being exported downstream. Also, wetlands that are frozen for long periods are generally in regions with shorter growing seasons, resulting in less opportunity for biological uptake of nitrate.	Warmth4
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.33	Floodplain wetlands are notably effective for removing N via denitrification and that process is limited by available carbon more than it is in bogs (Pinay et al. 2003). Bogs are typically nitrogen-poor (Heilman 1966) and thus are able to rapidly take up much of the nitrate that reaches them. Their acidic conditions inhibit generation of nitrous oxide as well as inhibiting nitrification (Dammann 1988) and the removal of nitrate via denitrification (Pinay et al. 2003). Denitrification is more prominent in fens and marshes than in acidic bogs. Bogs tend to cycle nitrogen internally and remove added N (Li & Vitt 1997, Bayley & Mewhort 2004), although due to acidic conditions and other factors, mosses in some wetlands have less capacity to take up apparently available N than do vascular plants (Heijmans et al. 2002, Berendse et al. 2001). Forested wetlands, especially those with an alder component or on slopes, may have less capacity to remove N via denitrification and may actually add nitrate via N fixation (Fellman & D'Amore 2007).	Wettype4
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	1	1			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.16667			0.17	Denitrification may be less under evergreen canopies than under deciduous because of the more shaded (cooler) microclimate and acidic soil conditions of the former.	WoodyTyp4

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Less canopy cover increases soil warming in spring which could accelerate denitrification, a major process for removing nitrate. However, tree roots can extend the subsurface zone of denitrification by oxidizing deeper subsurface areas. Trees also take up and temporarily retain nitrate, as well as adding carbon to the soil, which promotes denitrification. Therefore, a balanced interspersed mix of shading woody and non-shading herbaceous vegetation is hypothesized to enhance N removal.	TreeCanop4
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Dense vegetation offers frictional resistance to runoff, promoting deposition of organic nitrogen and resisting erosion of N-containing sediments. Vegetation takes up nitrate at least seasonally and plant roots can promote denitrification by providing a carbon source (Lin et al. 2002) and oxidizing otherwise anoxic subsurface soils (Brix 1994). However, shade from plants reduces soil temperature which slows the denitrification rate (Hogg & Lieffers 1991), and emissions of harmful nitrous oxide can be greater in wetlands with denser vegetation.	Gcover4
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.67	These features cumulatively decelerate runoff, thus allowing for more biological processing and deposition of nitrate-containing suspended sediments, although usually only to a minor degree. The presence of soil cracks implies a potential downward extension of the aerobic zone, interspersing it with anaerobic areas, which should lead to greater denitrification. Studies of wastewater treatment wetlands have shown greater nitrate removal where pockets of deeper water are interspersed with shallower areas (i.e., diverse microtopography).	Girreg4
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	2	2			
		Several (extensive micro-topography).	0	3	0			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					Upland soils are normally aerobic, whereas wetland soils are often anaerobic. Maximum denitrification occurs at the interface of aerobic and anaerobic conditions. Thus, if inclusions of aerobic non-wetland soils are numerous and interspersed throughout a wetland, the extent of denitrification overall should be greater.	Inclus4
		Few or none.	1	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	0	1	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				0.75	Denitrification rates are often limited by the amount of available carbon (Groffman et al. 2009, Capps et al. 2014). Organic soils have the most carbon, and coarse soils usually have the least. Denitrification enzyme activity, on a per gram basis, is typically greater in organic soils than mineral soils (Van Hoewyk et al. 2000). However, the acidic nature of many organic soils can limit denitrification, the major process for nitrate removal. Soils having less than 65% silt and clay have very limited capacity to remove nitrate via denitrification (Pinay et al. 2003). Emissions of nitrous oxide (a detrimental greenhouse gas) are most likely to occur in soils that are poor in organic matter but rich in nitrogen (e.g., the carbon-nitrogen ratio is less than 25, Hunt et al. 2007). The 40 cm threshold represents a frequent transition zone in some soil types from aerobic to anaerobic conditions; in other soils the transition occurs at about 25 cm	SoilTex4
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	4	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	3	0			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	1	3	3			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.33	Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008) .	SatPct4
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently	1	2	2			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Exposing sediments to the air can speed decomposition and cause them to release accumulated nitrate, potentially resulting in less removal. In contrast, long-duration flooding makes sediments anaerobic, which is necessary for the denitrification process (Westermann & Ahring 1987). Denitrification processes occur when anaerobic conditions occur, which are more likely when surface water is present and blocks gas exchange. Shallow inundation tends to decrease emissions of nitrous oxide (Zaman et al. 2007, Song et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct4
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	Denitrification rates are higher in vernal pools and other areas with that are inundated only seasonally, as compared with drier upland forests (Capps et al. 2014). Denitrification occurs at the interface between aerobic and anaerobic conditions, and such conditions often develop where a ponded area expands seasonally into vegetated areas. In addition, levels of soil organic matter are often higher in seasonal wetlands than in permanently inundated ones of comparable extent (Shaffer & Ernst 1999), and organic matter is key to supporting denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average*	SeasWpct4
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA.	0	3	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.40	Wetting and drying of sediments, as happens especially in wetlands with large and frequent water level fluctuations (because a wider area is subject to wetting-drying and associated aerobic-anaerobic shift), increases the loss of nitrate via denitrification (Groffman & Hanson 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu4
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	4	0			
		>2 m change.	0	5	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Ponded conditions provide longer time for nitrate processing, as well as causing sediments to lose oxygen, thus creating a microclimate favorable for denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondPct4
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	1	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	3	0			
		>95% of the water.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Plants take up nitrate from sediments and can facilitate retention if N is transferred to roots not as subject to erosion as foliage. Plants also facilitate sediment deposition by slowing the water, and some nitrate is associated with that sediment so is also deposited and potentially retained. Perhaps most importantly, roots of some plants oxidize the anoxic sediments that surround them and this facilitates denitrification, the major process for removing soluble nitrate from water. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov4
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	4	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider vegetated areas provide more area for biological processing of nitrate, and for nitrate adsorbed to sediment particles in runoff to be filtered and deposited. The most comprehensive and sophisticated analysis that used statistical procedures (meta-analysis) to synthesize results from over 60 peer-reviewed studies of nitrate removal by buffers in temperate climates found that widths of approximately 10 ft, 92 ft, and 367 ft are needed to achieve 50%, 75%, and 90% removal efficiencies for nitrate (Mayer et al. 2005, Mayer et al. 2007). This assumed that most inputs are through subsurface flow. When surface flow dominates (as often occurs during storms, and where subsurface storm drains have been installed around homes), buffers of 109 ft, 387 ft, and 810 ft are needed to achieve the same removal efficiencies (Mayer et al. 2005). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs4
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water and vegetation is hypothesized to support greater nitrate removal. That is because open water areas tend to be more aerobic, whereas densely vegetated areas often are anaerobic, except where plant roots oxidize a small part of the sediment. The combination of anaerobic and aerobic areas in close proximity facilitates nitrate loss through denitrification. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers4
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.33	Wetlands that lack outlets retain or remove all nitrate that enters them. Wetlands that connect to downslope water bodies for only part of the year may export less nitrate annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura4
		Persistent (surface water flows out for >9 months/year).	0	1	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	6	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	6	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for nitrate to be processed. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric4
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	2	2			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	0	1	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.25	Like a constricted outlet, vegetation and other obstacles create a "roughness" within a wetland that can slow the water and allow more time for biological processing of nitrate. This is much truer if the vegetation intercepts a large proportion of the flow during high-flow periods (i.e., is not merely along an upland edge that never floods). Water takes longer to move through complex channel networks (e.g., braided or sinuous) which themselves provide additional friction, thus allowing more suspended sediment and the nitrate associated with it to be deposited. Increased channel complexity also implies greater interspersion of open water and vegetation (see above) and in some cases, more hyporheic flow -- both of which favor nitrate removal. Wetlands with a sheet flow pattern often retain more nitrate than channelized systems (Morris et al. 1981, Knox et al. 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo4
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	4	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.00	pH is a strong predictor of denitrification in wetlands (Morse et al. 2012). Other factors being equal, the optimal pH for denitrification is 7 to 8.5, whereas a sharp decline occurs at a pH of less than 6 or greater than 8.5 (Simek & Cooper 2002). Acidifying Sphagnum mosses are most common below a pH of 5.5 (Vitt 2006). *In calculations, is excluded automatically (cell goes blank) if last choice selected and is set to 0.5 if second choice is selected. If pH is 6.0-8.5, score is set to 1, while outside this range is 0 This formula recognizes diminished rate of denitrification as pH becomes more acidic or basic.*	Acid4
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Many studies have highlighted the importance of subsurface (hyporheic) flow, or groundwater discharge, to denitrification rates in both riverine and non-riverine (e.g., Kroeger & Charette 2008) wetlands. Groundwater in many regions is iron-rich, and addition or removal of nitrate can significantly affect the ecological mobility of iron and perhaps some other metals in wetland soils (Shrestha et al. 2011).	Groundw4
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of suspended matter and the nitrate that is associated with it, and also supporting anaerobic conditions that lead to more nitrate removal via denitrification. Steeper gradients in a wetland imply greater potential for outflow and transport downslope, and more aerobic conditions.	Gradient4
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Constructed (and some restored) wetlands typically have lower soil organic matter (Shaffer & Ernst 1999), and that deficit limits the denitrification that otherwise removes nitrate. Thus, new wetlands would be expected to release the more nitrate to downstream waters. However, the proportion of incoming nitrate that is exported in some cases is greater in soils that are more fertile, i.e., nearing nitrate saturation, with a C:N ratio lower than 25 (e.g., Gundersen et al. 2006).	NewWet
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	0.33			0.67	Soil compaction seals up pores in the soil that serve as habitat space for denitrifying bacteria, as well as causing a larger proportion of the precipitation to leave as runoff rather than infiltrate into subsurface areas where denitrification is greatest. Soil erosion often results in loss of carbon-rich upper soil layers that are important to denitrification.	SoilDisturb4
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	Population centers, even when they do not drain into wetlands, can provide wetlands with more opportunity to remove N because population centers often generate more airborne N as a result of greater vehicle traffic, and this enters wetlands as N deposition.	PopDist4
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Vehicle emissions contain substantial N products, so road traffic often results in increased nitrogen deposition in wetlands. This increases the opportunity for N-removal, and thus the value of a wetland's capacity for N removal. Also, N removal efficiency increases exponentially with N deposition (especially when deposition is 0.25 to 0.50 g of N per year (Bragazza et al. 2004).	RdDist4
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
OF19	Water Quality Sensitive Watershed or Area	The AA is in a Protected Water Supply area (Designated Water Supply Area, Natural Watershed Municipal Surface Water Supply Area, or Municipal Water Supply Area) according to the provided KMZ overlay ("NS Protected Water Supply Areas"). Enter 1= yes, 0= no.	0			0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	GWsens
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					If excessive nitrate from upslope is entering a wetland, this provides more opportunity for the wetland to remove N and thus increases the value of any N-retention that the wetland provides. High nitrate levels often correspond with high levels of other pollutants.	NsampUp
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF21	Degraded Water Downstream	The problem described above is downslope from the AA, and:					See above.	NsampDown
		The condition is present within 1 km downslope and connected to the AA by a channel.	0					
		The condition is present within 5 km downslope and connected to the AA by a channel, or within 1 km but not connected to the AA by a channel.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.33	See the above. This indicator is highly correlated to it but is not identical.	Capct4
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	3	0			
		0.01 to 0.1.	0	2	0			
		0.1 to 1.	1	1	1			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	The need for (and value of) nitrate removal capacity (which is potentially provided by wetlands) is greater when upland runoff is rapid and erosive, with the potential to contribute much sediment and nitrate from other sources, as occurs when much of the contributing area contains impervious surface.	Imperv4
		<10%.	1	0	0			
		10 to 25%.	0	1	0			
		>25%.	0	2	0			
OF24	Transport From Upslope	A relatively large proportion of the precipitation that falls farther upslope in the CA reaches this wetland quickly as runoff (surface water), as indicated by the following: (a) input channel is present, (b) input channels have been straightened, (c) upslope wetlands have been ditched extensively, (d) land cover is mostly non-forest, (e) CA slopes are steep, and/or (f) most CA soils are shallow (bedrock near surface) and/or have high runoff coefficients. This statement is:				0.00	The need for (and value of) nitrate removal that potentially could be provided by wetlands is greater when upland nitrate loads are not being retained by features closer to the nitrate source. Vegetated buffers are more effective in protecting the quality of wetlands when most water enters the wetland as shallow subsurface lateral flow or discharging groundwater, rather than channel flow or surface runoff (Dillaha et al. 1989, Dosskey et al. 2001, Wigington et al. 2003, Mayer et al. 2005). Buffers in rural New York were found to be ineffective when crossed by small unmapped drainageways (e.g., roadside ditches) that were not buffered but were connected to pollution sources (Madden et al. 2007).	Transport4
		Mostly true.	0	2	0			
		Somewhat true.	0	1	0			
		Mostly untrue.	1	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Total available nitrogen in soil increases with increasing density of nitrogen-fixers such as red alder (Sanborn et al. 2002, Cortini & Comeau 2008). Consequently, wetland contributing areas with a large proportion of alder often export more nitrate to wetlands (Compton et al. 2003, Cairns & Lajtha 2005, Shaftel et al. 2012, Greathouse et al. 2014). Because this provides wetlands with increased opportunity to process the N, it increases the value of their role in the local ecosystem.	Nfix4
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Streams facilitate transport of nitrate from upland sources into wetlands, so an inflowing stream provides more opportunity for a wetland to perform this function.	Inflow4a
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Higher levels of N are commonly associated with higher levels of conductivity and TDS. Higher N concentrations indicate more opportunity for the wetland to remove N, thus making its provision of this service more valuable to downstream waters. *In calculations, is assigned score of 1 if TDS>300 mg/L or conductivity is >200 µS/cm or if plants indicate highly saline conditions. is excluded automatically (cell goes blank and ignored in model calculations) if not measured or lower levels are present.*	Conduc4
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter	0					
		Neither of above	0					
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.25	Other factors being equal, wetlands surrounded by little natural cover tend to receive higher loads of nitrate. Their nitrate removal role could thus be considered to be more essential and valuable for protecting waters further downstream. Even if the only watershed disturbance is logging, a typical post-logging shift from coniferous or mixed vegetation to deciduous vegetation can contribute 54% more nitrate to streams and alters the seasonal timing of the inputs and light availability (Roberts & Bilby 2009).	CAnatPct4
		<5%.	0	4	0			
		5 to 30%.	0	3	0			
		30 to 60%.	0	2	0			
		60 to 90%.	1	1	1			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	Pavement and other impervious surfaces facilitate transport of N-bearing runoff into downslope wetlands, thus increasing opportunities for N-removal. Increased opportunity translates into increased value of the wetland's N-removal service.	BuffCovTyp4
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.33	Increased slope in a watershed or buffer strip has been linked to increased delivery of sediment and sometimes nitrate to downgradient streams and wetlands, e.g., Trimble & Sartz (1957), Dillaha et al. (1988, 1989), Phillips (1989), Nieswand et al. (1990). However, an Ontario study found the slope of the contributing area had relatively little effect on concentrations of nitrate and carbon in a downslope riparian area. Soil carbon was more responsible for increasing nitrate removal, and soil carbon was actually greater on steeper slopes in that study area (Hazlett et al. 2008).	BuffSlope4
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	1	1	1			
		5-30%.	0	2	0			
		>30%.	0	3	0			
F65	Domestic Wells	The closest wells or water bodies that currently provide drinking water are:				0.00	Nitrate is a potentially serious contaminant of drinking water due to health effects on infants. Thus, when wetlands remove it before it contaminates groundwater, the wetlands are performing an especially valued service.	Aquifer4
		Within 0-100 m. of the AA.	0	2	0			
		100-500 m. away.	0	1	0			
		>500 m. away, or no information.	1	0	0			
S2	Accelerated Inputs of Nutrients	Stressor Subscore=	0			0.00	Because actual data on nitrate loads are lacking for many wetland watersheds, this approximation based on a host of N-generating activities is included as well.	Nsource4

Warmth	0.31	AVERAGE[(AVERAGE(WoodyTyp, TreeCanop, Groundw), AVERAGE(Warmth, Aspect)]	FrozDura4
Interception and/or Erosion Resistance	0.57	AVERAGE(PondPct, Width, FloDist, Gcover, Thruflo, Interspers, Elev, WetPctCA)	Intercep4
Connectivity	0.61	AVERAGE(OutDur, Gradient, Constric)	Connec4
Organic	0.44	AVERAGE(Acid, SoilTex, WetType, NewWetland, AqPlantCov, SoilDisturb)	Organic4
Redox	0.48	(AVERAGE(SatPct, Persis, SeasPct) + AVERAGE(Fluctu, UpEdgeShape, Inclusions, Girreg))/2	Redox4

Function Score for Nitrate Removal	F	4.98	IF((NoOutlet=1), 1, IF((AllSat1=1), (2*Connec + Intercep + FrozDur + Organic + Redox)/6, ELSE: (3*Redox + 2*Connec + FrozDur + Organic + Intercep)/ 8)))
Benefits Score for Nitrate Removal	B	10.00	MAX[Aquifer, GWsens, Inflo, MAX(NSource, NsampUp, NsampDown, Nfix), AVERAGE(Imperv, RdDist, PopDist), AVERAGE(CAnatPct, BuffSlope, BuffCovTyp, Transport)]

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Carbon Sequestration	The effectiveness for retaining both incoming particulate and dissolved carbon, and through the photosynthetic process converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").	CS

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetland emissions of methane increase with warming temperatures (Moosavi et al. 1994, Sha et al. 2011). Although plants responsible for much of the carbon sequestration in wetlands grow fastest at warmer soil or sediment temperatures, they also decompose faster. With colder temperatures (fewer degree days), the concentration of mobile DOC in forested wetland soils and streams decreases, suggesting more immobile carbon is sequestered onsite rather than being exported downslope in groundwater (D'Amore et al. 2010).	Warmth5
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.75	Bogs have the deepest peat layers and thus more stored carbon than more fertile wetlands (fens) (Glenn et al. 2006). Methane emissions tend to be greater from fens, marshes, and other wetlands with water table near the ground surface for long periods (Liblik et al. 1997). Swamp soils may have greater releases of methane due to their greater diurnal fluctuations in water tables resulting from tree evapotranspiration. Methane emissions may be especially large from wetlands with emergent sedges (a common feature of fens) because they facilitate translocation of methane from sediments to the air (Hines et al. 2008).	Wettype5
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	3	3			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.83			0.83	Fixed carbon tends to cycle more rapidly in deciduous plant litter, thus supporting less sequestration. *In calculations, is excluded automatically (cell goes blank) if woody vegetation is absent. Otherwise, score is the reciprocal of the maximum deciduous cover among the 3 height classes, adjusted to a 0-1 scale.*	DecidTree5
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					Larger trees represent larger stores of sequestered carbon, but younger trees fix and accumulate carbon more rapidly (Anwar 2001, Ryan 2005). In New Brunswick, natural stands of sugar maple or yellow birch are believed to sequester the most carbon (Neilson et al. 2007). However, evergreen foliage from coniferous species tends to foster acidic conditions which slow the decomposition of organic matter (Collins and Kuehl 2001), thus leading to greater carbon sequestration. Acidic conditions and/or slowly-decomposing (recalcitrant) evergreen vegetation also can repress both methane generation (Valentine et al. 1994, Updegraff et al. 1995) and methane oxidation, but not necessarily CO2 emissions (Bridgham & Richardson 2003). Carbon can be sequestered more effectively under such conditions (Blanco-Canqui & Lal 2004). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeForm5
		coniferous, 1-9 cm diameter and >1 m tall.	0	2	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	1	0			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	1	0			
		coniferous, >40 cm diameter.	0	2	0			
		broad-leaved deciduous >40 cm diameter.	0	1	0			
F10	Sphagnum Moss Extent	The cover of Sphagnum moss (or any moss that forms a dense cushion many centimeters thick), including the moss obscured by taller sedges and other plants rooted in it, is:				1.00	Mosses contribute at least 48% of the productivity of some wetlands. Although the rate at which bogs store new carbon is relatively low, and because mosses decompose more slowly than woody and herbaceous plants, the peat layer in bogs and fens represents a considerable amount of carbon that already has been sequestered. Peat hummocks are particularly effective for sequestering carbon (Asada & Warner 2005). On a per unit area basis, bogs and other moss-covered areas generate less methane than many other wetlands (Hines et al. 2006, 2008),	MossCov5
		<5% of the vegetated part of the AA.	0	1	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	1	5	5			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				1.00	The presence of peat or muck implies the presence (at least historically) of a microclimate favorable to long-term retention of particulate carbon. Peat is also a poor substrate for methanogenesis (White et al. 2008) but that is also true of well-oxygenated coarse soils (Grunfeld & Brix 1999). However, in very coarse soils the annual productivity of plants is often less than in clay/ loam soils because, unless the coarse soils are flooded regularly by rivers, they tend to be nutrient-poor. Moderately coarse soils (silts, loams), especially those with a large component of soil aggregates in the 2-8 mm range (Hossler & Bouchard 2000), tend to have neutral pH and support greater plant productivity and thus more soil organic carbon.	SoilTex5
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	4	0			
		Shallow Peat or organic <40 cm deep.	1	5	5			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F18	Sedge Cover	Sedges (Carex spp.) and cottongrass (Eriophorum spp.) occupy:				0.67	Among wetland plants, those best known for facilitating the emission of methane from sediments are sedge and cottongrass (Marinier et al. 2004, Strack et al. 2006, Green & Baird 2012). However, one study found methane production from cattail litter was almost 3 times greater than from sedge litter (Williams & Yavitt 2010), and alder also has been found to facilitate methane emissions from wetlands (Smialek et al. 2006, Gauci et al. 2010). *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous cover, or if cover is entirely forbs.*	Sedge5
		<5% of the vegetated area, or none.	0	3	0			
		5-50% of the vegetated area.	1	2	2			
		50-95% of the vegetated area.	0	1	0			
		>95% of the vegetated area.	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Accumulation of carbon as peat is fostered by persistently high water tables or flooded conditions, due to the anaerobic and acidic conditions which slow decay of organic matter (Belyea & Malmer 2004). However, persistently high water tables also increase carbon loss from emissions of methane (Glatzel et al. 2004, Keller et al. 2004, Pelletier et al. 2007, Altor & Mitsch 2008) and occasionally CO2, although a Saskatchewan study found greater methane release from wetlands flooded for short periods each year than from those flooded semi-permanently (Pennock et al. 2010). Methane emissions in one study occurred mostly when water content of the soil exceeded 25% (Smith et al. 2000). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct5
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	At least in riverine wetlands, overall "average" methane emission from hydrologically pulsed sites may be less than that from sites where inundation is permanent (Mitsch et al. 2005, Altor & Mitsch 2008). Flooding from seasonally connected water bodies also promotes greater plant productivity, which provides more organic matter that potentially can be stored. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct5
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.60	Very large water level fluctuations can reduce plant productivity and increase the release of methane. Maintaining steadily moist conditions (i.e., little or no water level fluctuation) may minimize methane releases (Tuittila et al. 2000, Price et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu5
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	Waters that are persistently deeper than 2 ft, and especially deeper than 6 ft, usually support much less vascular plant production which otherwise could be sequestered while acidifying the soil and thus dampening methane emissions. In a flooded pasture of wild hay, plant production declined if continual flooding exceeded 50 days at a depth of 7 inches (Rumberg & Sawyer 1965). On the other hand, methane emissions can decrease with increasing depth of surface water over the range of 0 to 1m depth (Pelletier et al. 2007, Cheng et al. 2007). One study found methane emissions were greater from a lake than a bog (Edwards et al. 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth5
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	2	2			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.33	Annual plant productivity (and thus potentially-storable carbon) is often less in ponded wetlands than in wetlands where periodic water circulation replenishes nutrients (Thormann & Bayley 1997). Also, methane emissions may be higher in ponded areas because such areas are more likely to develop anaerobic conditions (Magenheimer et al. 1996, Tranvik et al. 2009). Aerobic conditions can increase the proportion of plant production that is allocated to belowground tissue, which benefits carbon storage because such tissue is more likely to resist erosion and be incorporated into longterm storage in soil. However, organic matter in ponded areas is less subject than organic matter in channels to being transported downslope in floodwaters or groundwater and thus could be more likely to become incorporated into soils, resulting in carbon being sequestered. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet5
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to F34.	1	1	1			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	2	0			
		>95% of the water.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants, especially those in acidic environments and/or with fibrous tissue, usually add more carbon to wetlands than they lose in the form of CO2 from decomposition. They also trap and deposit particulate carbon carried into a wetland from upslope. However, decomposition of the organic matter from plants in some wetlands generates methane. Methane emissions per unit area can be high in floating mats of vegetation (Moosavi et al. 1996) and in shallow areas with dense cover of vascular plants (Smith et al. 2000, Cheng et al. 2007) whose roots facilitate the movement of methane from soils to the surface, as compared with lower methane emissions in areas of open water (Rose & Crumpton 2006) or mats of submersed aquatic vegetation (Smith et al. 2000). Nonetheless, at least in restored wetlands, the net effect on carbon balance over a projected 33-year period is sequestration (Badiou 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov5
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider bands of vegetation represent more biomass to be sequestered, and are more effective in trapping organic matter carried to the wetland by upland runoff. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs5
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.60	Wetlands that lack outlets retain most carbon that enters them or is produced within. However, methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Wetlands that connect to downslope water bodies for only part of the year would be expected to export less carbon annually than those with persistent outflow. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura5
		Persistent (surface water flows out for >9 months/year).	0	3	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	6	6			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	8	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	10	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	10	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus causing water to back up into the wetland, which allows more time for scarbon in suspension to settle, although methane emissions may be higher due to greater likelihood of anaerobic conditions developing. Ditching of some wetlands may reduce methane emissions in the long term but initially accelerates the decomposition and loss of historically stored carbon. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric5
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	3	3			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	0	2	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				1.00	Where groundwater is anaerobic (as it often is) it can stimulate methane emissions, as can its usually circumneutral acidity (Updegraff et al. 1995). As a result less carbon may be sequestered in some groundwater-fed wetlands (Smemo &Yavitt 2006). However, in many wetlands groundwater also increases the levels of iron, calcium, and sulfate in surface water (Heagle et al. 2007) which can result in less methane emission. Lakes and wetlands with large groundwater inputs may have less organic matter in their sediments (Squires et al. 2006), thus generating less methane.	GroundW5
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	0	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	2	2			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Flatter wetlands are more likely than steep ones to slow runoff, facilitating more deposition of organic matter that is associated with it. However, a Pennsylvania study found that slope wetlands tended to have moderate to high rates of organic matter accretion compared with other wetland geomorphic types (Wardrop & Brooks 1998). Also, methane emissions may be less from sloping wetlands, due to greater aeration of their soils (Tauchnitz et al. 2008).	Gradient5
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					The initial sparseness of vegetation in new wetlands suggests that overall carbon stores are less than in some of the more mature wetlands with greater plant cover, diversity, and structural complexity. Aboveground production and soil organic matter have been shown to be less in lands newly restored to wetland conditions than in long-established wetlands (Fennessy et al. 2008). However, many pioneering plants in new wetlands (especially on fertile soils) grow rapidly and thus are fixing large amounts of carbon per plant per unit time. In recovering windfall areas mosses established a dense carpet on windthrow mounds within the first few decades after the disturbance and quickly sequestered carbon. They were found to comprise as much as 25% of understory plant biomass and as much as 50% of understory productivity (den Ouden & Alaback 1996).	NewWet5
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.67	Although burning potentially releases (rather than sequesters) large amounts of carbon from wetland soils, in the longer term, mosses recover within a few decades of surface burns (Kuhry 1994), and occasional surface burning can concentrate soil inorganic material in surface peat, thereby decreasing fuel quality and the likelihood of supporting severe fires in the future. Loss of soil organic matter from burning can also result in a drop in wetland surface elevation, thus promoting wetter conditions and increasing fire resistance for years post-burn (Watts et al. 2015). Although burning produces a period of minimal carbon storage immediately post-fire, vegetation recovery through succession within a few decades promotes long-term persistence of vegetation communities with greater rates of carbon sequestration than those of unburned (late successional) communities (Benscoter et al. 2012).	Burn5
		Burned within past 5 years.	0	0	0			
		Burned 6-10 years ago.	0	1	0			
		Burned 11-30 years ago.	0	3	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	2	2			
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor Subscore=	0			0.67	Tillage, regrading, or other soil disturbances can accelerate the decay of soil organic matter rather than supporting sequestration (Waddington & Turetsky 2008). Farming of drained hydric soils is a particular concern, because such soils typically have substantial organic matter that converts to greenhouse gases when tilled and planted annually. However, tillage of compacted soils can reduce methane emissions (Willey & Chameides 2007). Despite associated soil disturbance, selective logging in forested wetlands in some cases may increase carbon sequestration, at least temporarily, if the tree stands and other components of the forest ecosystem become more productive after thinning (Li et al. 2004, D' Amore et al. 2015).	SoilDisturb5

Historical Accumulation	0.80	AVERAGE(SoilDisturb, MossCov, Wettype, Burn, SoilTex, AVERAGE(Warmth, DecidPct, DecidTree, Width, NewWetland))	HistAccum5
Slowed Decomposition	0.79	AVERAGE(Depth, AVERAGE(Freeze, Warmth, MossCov, WetType)	Productiv
Physical Accumulation	0.61	AVERAGE (OutDura, Constric,AqPlantCov, Gradient, IsoWet)	PhysAccum5
Methane Limit	0.71	AVERAGE(MossCov, Sedge, SeasPct, Fluctu, Groundw, TreeForm, PermWpct)	MethLimit5

Function Score for Carbon Sequestration	F	7.55	(2*MAX(HistAccum, PhysAccum) + Productiv +3*MethLimit) /6
Benefits Score for Carbon Sequestration	B		NOTE: No indicators addressing VALUES of this function are currently proposed because its value is diffused throughout the entire planet.

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Organic Nutrient Export	The effectiveness for producing and subsequently exporting organic nutrients, either particulate or dissolved, along with associated compounds and elements such as iron.	OE

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF26	Internal Flow Distance (Path Length)	The horizontal flow distance from the wetland's inlet to outlet is:				0.57	Longer flow paths allow for more interaction between runoff and wetland vegetation, which potentially leads to removal and export of more decomposed organic matter.	FloDist6
		<10 m.	0	1	0			
		10 - 50 m.	0	2	0			
		50 - 100 m.	0	3	0			
		100 - 1000 m.	1	4	4			
		1- 2 km.	0	5	0			
		>2 km, or wetland lacks an inlet and outlet.	0	7	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are most productive at warmer soil or sediment temperatures, and their foliage that contributes organic matter to downslope food chains decomposes most rapidly under warmer conditions (Fissore et al. 2009). Those conditions are described by increasing mean annual temperature. As soil temperatures increase, so does the concentration of DOC in forested wetland soils and streams, and in that form carbon is readily exported (D'Amore et al. 2010). The production of Sphagnum moss in particular is greater in warmer areas (Gunnarsson 2005). However, ice that is more prevalent in cooler regions can erode organic matter and aid its transport out of a wetland during ice-melt periods.	Warmth6
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				1.00	Carbon from marshes and fens is often more biodegradable (and thus more exportable and valuable to food chains over a wider area) than bog and forested wetland carbon (D'Amore et al. 2010). The same may be true of riparian shrub/forest wetlands, and their connectivity to other water bodies is usually greater, potentially leading to greater export (Dalva & Moore 1991). Bogs usually have the largest amounts of carbon in storage (as peat), and some bogs fix carbon more readily than more fertile wetlands (fens) (Moore 1989, Glenn et al. 2006), but connectivity to other water bodies is generally less than other wetland types, with carbon being exported mainly in dissolved form via groundwater.	Wettype6
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	4	4			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Nitrogen added to a wetland by N-fixing plants can increase the wetland's overall plant productivity, potentially making more organic matter available for export. Presence of alder in conifer woodlands also can speed the decomposition of organic material from the conifers (Fyles & Fyles 1993) perhaps making it more useful for supporting aquatic life.	Nfixer6
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	More extensive ground cover may imply more organic matter is available for export. However, excessive litter buildup implies a lack of significant exporting forces, e.g., currents.	Gcover6
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				1.00	Soils with a thick organic layer have the most carbon available for export. However, moderately coarse soils (silts, loams) are better-aerated, less acidic, and thus can have greater plant productivity. Very coarse soils, unless flooded regularly by rivers, tend to be nutrient-poor thus limiting plant productivity. However, their presence may indicate periodic exposure to water currents capable of exporting carbon, and coarse soils sometimes support greater plant productivity because greater infiltration can reduce the frequency of anoxic conditions that stifle productivity of some rooted plants.	SoilTex6
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	2	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	1	4	4			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	Prolonged inundation can stifle plant productivity, whereas seasonal inundation encourages it, and is often associated with conditions that contribute to the export of organic matter, e.g., river floods. Seasonally high water levels promote decomposition (Bayley & Mewhort, 2004) and thus facilitate the export of carbon. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct6
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.25	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc6
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	1	1			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	3	0			
		>2 m change.	0	4	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.80	Annual productivity is generally greater in shallower areas where light is more available and sediments are subject to aeration from wind mixing. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth6
		<10 cm deep (but >0).	0	5	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				1.00	Flowing rather than ponded waters provide the most opportunity for organic matter to be exported from wetlands (Urban et al. 1989, Dalva & Moore 1991). In some regions, flowing waters also tend to be more productive because nutrients from further upstream are continually introduced into the wetland and replenished. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PondedPct6
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	4	4			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	2	0			
		70-95% of the water.	0	1	0			
		>95% of the water.	0	0	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The probability that organic matter from wetland plants will be exported increases in relation to the percent of the inundated area containing such plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov6
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	6	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	5	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.60	The plant material from narrower (fringe) wetlands is often more vulnerable to transport into adjoining waters. However, wider wetlands represent larger total stores of organic matter available for waterborne export downstream or offsite (Pacific et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	VwidthAbs6
		<1 m.	0	4	0			
		1 - 9 m.	0	5	0			
		10 - 29 m.	0	4	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	2	0			
		> 100 m, or open water is absent at that time.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of open water with vegetation promotes greater export of organic matter from the vegetation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers6
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	2	0			
		Intermediate.	0	1	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	0	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.80	Boreal streams are an important transporter of protein-rich, labile DOM (Urban et al. 1989, Gergel et al. 1999, Xenopoulos et al.2003, Fellman et al. 2009). Thus, annual export of accumulated organic matter to downstream water can be greater in wetlands with outlets, especially those with persistent outflow. Nonetheless, even wetlands that lack outlets may export variable amounts of dissolved carbon via subsurface infiltration and "pipes" created by decayed subsurface peat and tree roots which cannot be evaluated in a rapid assessment. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura6
		Persistent (surface water flows out for >9 months/year).	0	5	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	4	4			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	3	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	1	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.00	Narrow outlets limit water outflow from a wetland and its downstream or downslope movement, thus limiting export of organic matter. The types of outlets described here are ones that typically are more constricted than natural channels, which usually have adjusted over time to local runoff and thus are wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric6
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	0	0			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	0	1	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Increased channel complexity implies greater interspersion of open water and vegetation, which provides more opportunity for organic matter to be in contact with moving water and thus be exported. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo6
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	1	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater-fed wetlands remain ice-free for longer, thus lengthening the growing season and plant production, and increasing the potential for organic matter to be exported if the wetland is connected to other water bodies. However, groundwater generally contains less dissolved organic carbon than does surface runoff (Emi-Fergus et al. 2011). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw6
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Steeper gradients imply a greater likelihood that whatever organic matter is produced will be transported offsite.	Gradient6
		<2% or the AA has no surface water outlet (not even seasonally).	0	0	0			
		2-5%.	1	2	2			
		6-10%.	0	3	0			
		>10%.	0	4	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Soil organic matter is slow to accumulate in constructed wetlands (Alsfeld et al. 2009), so less is likely to be available for export.	NewWet6
		No.	0	5	0			
		Yes, and created or expanded 20 - 100 years ago.	0	2	0			
		Yes, and created or expanded 3-20 years ago.	0	1	0			
		Yes, and created or expanded within last 3 years.	0	0	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Historical Accumulation	1.00	AVERAGE(SoilTex, NewWet)	HistAccum6
Current Productivity:	0.49	AVERAGE(Frozen Duration, Plant Cover, Nutrient Availability) WHERE:	Productiv6
Frozen Duration	0.13	AVERAGE(Warmth, Groundw)	FrozDura6
Plant Cover & Type	0.90	AVERAGE (AqPlantCov, Decid, DecidTree, Gcover, Depth)	PlantCov6
Nutrient Availability	0.44	AVERAGE(Wettype, SeasWpct, Fluctu, Nfix)]	NutrAvail6
Export Potential	0.60	AVERAGE [OutDura, Gradient, FloDist, AVERAGE(Constric, ThruFlo, Interspers, Width, PondedPct)]	ExportPot6

Function Score for Organic Nutrient Export	F	6.29	IF((NoOutlet6=1),0, ELSE: (3*ExportPotential+ 2*CurrentProductivity + HistoricalAccumulation) /6

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Anadromous Fish Habitat	The capacity to support rearing or spawning habitat of fish species that migrate from marine waters into freshwater streams to spawn. Catadromous species (e.g., eels that spawn in marine waters but spend most of their life in fresh) are also included.	FR					

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	If accessible and otherwise suitable for fish, wetlands closer to the coast are more likely to support anadromous species due partly to reduced duration of ice cover, shorter instream migration routes, and potentially elevated aquatic productivity.	TidalProx9
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.02	Wetlands located lower in a watershed are generally more accessible to anadromous fish.	Elev9
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					A wetland exposed to toxic substances has less or no capacity to sustain anadromous fish. Fish are especially sensitive to heavy metals such as copper (Scannell 2009).	ToxData9
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				1.00	Impervious areas do not contribute many terrestrial insects to aquatic food chains, may reduce aquatic productivity due to high turbidity and sedimentation of spawning areas, and can raise stream temperatures to levels harmful to anadromous fish.	ImpervCA9
		<10%.	1	2	2			
		10 to 25%.	0	1	0			
		>25%.	0	0	0			
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				0.00	Regardless of the accessibility and quality of a wetland, if anadromous fish cannot access the larger watershed of which it is a part, the wetland will be unable to currently support anadromous fish.	Access9
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	2	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Salmon are highly sensitive to water acidity and the effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	Karst9
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.75	Of the wetland types listed, riparian and marsh wetlands are typically most important to anadromous fish because they have the most water and are the most accessible. When accessible, other wetland types are used but invertebrate foods may be less abundant due to acidic conditions.	Wettype9
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	3	3			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, LeSage et al. 2005). From that, it can be inferred that fish production should be higher as well, where food is limiting fish survival.	Nfix9
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.20	Wetlands that are never inundated cannot support anadromous fish directly.	SatPct9
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	1	1			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Areas of persistent water within or adjoining a wetland are necessary to provide refuge, spawning habitat, and travel corridors for all anadromous fish. However, areas of a wetland that dry out seasonally are also important so wetlands that are entirely comprised of persistent water may be no more important than those that have a mix of persistent water areas and seasonally-inundated-only areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct9
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F26	% of Summertime Water that Is Shaded	At mid-day during the warmest time of year, the area of surface water within the AA that is shaded by vegetation and other features that are within the AA at that time is:				0.40	Most anadromous fish require relatively cool waters, and shade helps maintain cool water temperatures, especially in lowland streams during low flow conditions. Cool waters (less than 68 degrees F, ideally less than 60F) are particularly important to salmonid fish because at higher temperatures less of the dissolved oxygen necessary for their survival (a minimum of 5 ppm is needed by most local fish) is able to remain in the water. However, shade also can reduce algal productivity and thus the abundance of aquatic insects, although this may be compensated somewhat by increased availability of terrestrial insects that fall off the shading vegetation and into waters where they are fed upon by fish. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if water is present only seasonally, or if wetland is in the lower third of a watershed (because shade has less effect on water temperature in the wider channels there).*	Shade9
		<5% of the water is shaded, or no surface water is present then.	0	1	0			
		5-25% of the water is shaded.	1	2	2			
		25-50% of the water is shaded.	0	3	0			
		50-75% of the water is shaded.	0	5	0			
		>75% of the water is shaded.	0	4	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				1.00	Many studies have demonstrated the importance to anadromous fish of streams and wetlands that are inundated only seasonally, provided fish can enter and exit them then (e.g., Brown & Hartman 1988, Nickelson et al. 1992, Freeman et al. 2007, Meyer et al. 2007, Welsch & Hodgson 2008). Even during brief periods of high water, fish enter those areas and gorge themselves on invertebrates made more available by the flooding. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct9
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Except when spawning, most anadromous fish spend much of their time in deep water because of the typically cooler temperatures and cover it provides. Preferred depths vary by species, season, and channel type. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth9
		<10 cm deep (but >0).	0	2	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish, and support higher productivity of invertebrates fed upon by fish. However, as aquatic plants decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	AqPlantCov9
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers9
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Many studies have demonstrated that large woody debris is critically important to coho and steelhead. It provides cover and creates instream pools that help protect young fish from aerial predators. Shade from pools also provides cooler water preferred by salmonids. Removal of woody debris from one stream reduced salmonid use to one-fifth the levels with woody debris (Fausch & Northcote 1992). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove9
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.67	Fish access to wetlands is better, and oxygen deficits harmful to fish are less frequent, if outflows from the wetland are persistent (Henning et al. 2006, 2007). Connectivity between tributaries and more permanent mainstem streams is essential to anadromous fish which use many off-channel habitats. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura9
		Persistent (surface water flows out for >9 months/year).	0	3	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.33	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	Thruflo9
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Atlantic salmon eggs and smolts are particularly sensitive to low pH (Rosseland et al. 2001, McCormick et al. 2012). *If pH is between 5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	Acid9
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver9
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Especially in riverine wetlands, groundwater (hyporheic flow) that discharges into wetlands is extremely important to salmonids because of its cooler temperature. However, in some instances this "iron floc" decreases the oxygen required by fish and smothers fish spawning gravels. Groundwater influx is sometimes indicated by an orange precipitate, indicating the presence of iron oxidizing bacteria (Dickman & Rygiel 1998).	GroundW9
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as contributing terrestrial insects (Wipfli 1997) and supporting richer and healthier aquatic invertebrate communities. All of these factors help support anadromous fish. Within 90 years after clear-cut logging without a 100-ft wide stream-side buffer, LWD could be reduced by 70% and recovery to prelogging levels would take more than 250 years. Also, establishment of conifer plantations can acidify receiving waters and potentially harm Atlantic salmon eggs (Kreutzweiser et al. 2008, Drinan et al. 2013, Malcolm et al. 2014). However, overall intensity of land use and forest fragmentation in a stream's watershed sometimes has a greater influence on stream fish abundance than does buffer width (e.g., Shandas & Alberti 2009, Stephenson & Morin 2009). The effects of buffer width or proportion of forest in the watershed can also be overshadowed by differences in stream substrate type and flow duration (Roy et al. 2005).	BuffPctNat9
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	In the Seattle area, salmon were dominant only in streams whose contributing areas contained less than 5% impervious surface. Salmon were essentially absent from streams draining areas with more than 35% impervious surfaces (May et al. 1997). Some types of watershed disturbances are probably more harmful to anadromous fish habitat than others. Impervious surfaces and storm drains, even when occurring at low densities but near drainageways that lead to the same stream or wetland, can dramatically alter the amount, timing, frequency, and duration of flow in streams and water level in lakes and wetlands (Booth et al. 2002, Konrad et al. 2005, Poff et al. 2006, Shields et al. 2008); increase pollutant loads and concentrations (Chadwick et al. 2006, Morgan et al. 2007); disrupt channel configurations (McBride & Booth 2005, Colosimo & Wilcock 2007); shift local air and water temperature regimes (Delgado et al. 2007); introduce chronic noise, predators, and other disturbances (Hepinstall et al. 2008); and as a consequence of these and related factors, alter the abundance, diversity, and species composition of fish and wildlife communities (Miltner et al. 2004, Hansen et al. 2005, Alberti et al. 2007, Walsh & Kunapo 2009, Cookson & Schorr 2009). *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	BuffLU9
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of fish are closely linked to specific thermal, olfactory, and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation timing (to which fish are not adapted) can reduce survival and ultimately populations. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime9
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0			0.56	High levels of contaminants (especially heavy metals such as copper) can be detrimental to anadromous fish.	ToxinIn9
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.25	Excessive sediment in spawning areas smothers fish eggs, limits aquatic productivity, contributes to surface water warming, and thus potentially adversely affects anadromous fish habitat (Kemp et al. 2011, Sear et al. 2008). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedIn9
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.25	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopCtr9
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd9
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core9
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0				A direct indicator of value, at least for some species.	Fishing9
	Function Score for Feeding Waterbird Habitat					0.57	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., loons, grebes, cormorants, kingfisher) and mammals.	WbirdFeed

Hydro Regime	0.57	AVERAGE(Depth, SatPct, MAX(SeasWPct, PermWPct), Lake, Interspers, ThruFlo)	Hydropd9
Structure	0.79	AVERAGE[Beaver, AVERAGE(Wettype, WoodAbove, AqPlantCov, Shade, IsoWet)]	Struc9
Productivity	0.27	AVERAGE(GroundW, TidalProx, Elev, Wettype, Karst, Nfix)	Produc9
Landscape	0.89	AVERAGE(NatVegPctCU, BuffLU, ImpervCA)	Lscape9
Stressors	0.25	MIN(Acid, ToxicIn, SedIn, AltTime, ToxData)	Stress9

Function Score for Anadromous Fish Habitat	F	0.00	IF((Access=0),0,
			IF((AllSat1=0),0, ELSE:
			(AVERAGE(Access, OutDura)) X (AVERAGE(HydroRegime, Structure, Productivity, LScape, Stress))

Benefits Score for Anadromous Fish Habitat	V	1.65	AVERAGE(WbirdFeed, Fishing, Core, PopCtr, DistRd)

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Resident Fish Habitat	The capacity to support an abundance and diversity of native fish (both resident and visiting species) that are not anadromous or catadromous, e.g., Dolly Varden, cutthroat trout.	FR						
#	**Function Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Obviously, a wetland containing toxic substances has much less capacity to support anadromous fish. Resident fish are especially prone to bioaccumulation of locally-sourced metals (e.g., Deniseger et al. 1990).	ToxData10
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects and ultimately resident fish. Risk of winterkill by long-duration ice cover also may be less in warmer parts of the region.	Warmth10
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:				1.00	Increased access to wetlands by anadromous fish can make other fish more vulnerable to competition or predation by anadromous fish. For non-anadromous fish, access to other water bodies is helpful to escape temporary oxygen deficits (particularly under ice in winter) and to access additional food and spawning areas, but is not always essential.	Access10
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	1	1			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.					Many fish and their supporting aquatic food webs are sensitive to water acidity. The effects of acid precipitation have been greatest in the areas shown on the map. *In calculations, this indicator is applied only in Nova Scotia.*	
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.75	Of the wetland types listed, riparian and marsh wetlands are typically most important because they have the most water and are the most accessible to resident fish. When accessible, other wetland types are used but invertebrate foods may be less abundant in those due to acidic conditions.	Wettype10
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	3	3			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2				
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	4	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005). From that, it can be inferred that fish production should be higher in alder wetlands as well, where food is limiting fish survival.	Nfix10
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Even if not connected to other water bodies, lakes are used extensively by resident fish, and lakeside wetlands provide shelter, rich feeding areas, and substrate for spawning by some species. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Lake10
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.20	Used as a classifier. Wetlands that are never inundated cannot support resident fish.	SatPct10
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	4	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	1	1			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Persistent surface water is essential to resident fish in isolated wetlands, and is important to resident fish even in wetlands that connect seasonally to other water bodies. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct10
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.25	Most resident fish spend much of their time in deeper water because of the cover it provides. Wetlands with deeper water provide more habitat space. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth10
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	1	1			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	4	0			
		>2 m deep. True for many fringe wetlands.	0	3	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.00	Different resident fish species have different habitat needs, and a variety of depths within a wetland implies greater capacity of the wetland to meet the needs of multiple species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 10
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	1	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	0	1	0			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Aquatic plants provide cover for fish and in some cases the associated shading helps maintain cool water temperature. However, as they decay beneath winter ice, they can deprive fish of necessary oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct10
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	0	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	2	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	1	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater interspersion of open water with vegetation provides resident fish with greater access to food sources, such as insects falling off emergent plants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers10
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect young fish from aerial predators and provides cooler water preferred by salmonids. *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	WoodAbove 10
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.67	Fish access to wetlands is better if an outlet is present and outflows from the wetland are persistent. Although isolated wetlands with persistent surface water can support some resident fish, a permanent connection to other surface waters increases the ability of fish to move among wetlands and other surface waters in search of food and other needs. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	OutDura10
		Persistent (surface water flows out for >9 months/year).	0	3	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	2	2			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	1	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	0	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	0	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.33	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for fish and their invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo10
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	3	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	3	0			
F47	pH Measurement	The pH in most of the AA's surface water:				0.50	Fewer resident fish thrive in acidic (low pH) wetlands and ponds. However, as pond size increases and they begin to resemble lakes, pH often increases and consequently the ability to support a wider array of fish (Rempel & Colby 1991, Kimmel & Argent 2010, Sutela et al. 2010). *If pH is between 7.5 and 9, the function score is set to 1, otherwise 0.5 if water is not tea-coloured, 0 if it is.*	AcidicPool10
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce more fish (Rempel & Colby 1991, Kimmel & Argent 2010) but levels greater than about 2000 mg/L TDS are usually harmful (Weber-Scannell & Duffy 2007). *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm or if plants indicate highly saline conditions. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other measurements are assigned a score of 0.5.*	Conduc10
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Over the long term, beaver dam-building activities are highly beneficial to fish rearing habitat, creating pools used by fish as refuge, adding wood that provides fish cover, and increasing the overall productivity of river systems (Collen & Gibson 2001). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver10
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Groundwater provides relatively warm temperatures that can maintain ice-free conditions for longer, and helps sustain water levels and low flows, thus increasing annual production. However, the "flocs" created by the presence of iron oxidizing bacteria in some instances causes groundwater to be deficient in oxygen that is critical to resident fish, especially when this occurs under winter ice cover.	Groundw10
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	Streams adjoined by natural vegetation provide shade that helps maintain water temperature, as well as supporting richer and healthier communities of fish as well as invertebrates. Often, only very tolerant fish species are present in streams in heavily urbanized areas (Yoder et al. 1999) and invasive species may enjoy a competitive advantage over native species under urban conditions.	NatVegCU pct10
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.75	Life histories of resident fish are closely synchronized to natural hydrologic patterns. Wetlands where that has been disrupted will have lower capacity to support resident fish. *In calculations, is excluded automatically (cell goes blank) if wetland has no surface inflows.*	AltTime10
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.25	Excessive sediment limits aquatic productivity, contributes to surface water warming, and thus adversely affects resident fish habitat (e.g., Gray et al. 2005). It also is directly stressful to fish. However, in some cases moderate turbidity can provide cover from aerial predators.	SedExcess 10
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to population centers.	PopDist10
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	Number of anglers -- an indicator of fish value --would usually be expected to increase with increasing proximity to roads which facilitate access to wetlands with fish.	DistRd10
		<10 m.	0	5	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	2	0			
		100 - 500 m.	0	1	0			
		>500 m.	1	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Number of anglers -- an indicator of fish value -- would usually be expected to increase when more parts of a wetland are physically accessible.	Core10
		<5% and no inhabited building is within 100 m of the AA.	0	3	0			
		<5% and inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			
F64	Consumptive Uses (Provisioning Services)	Fishing.	0			0.00	A direct indicator of value, at least for some species.	Fishing10
	Function Score for Feeding Waterbird Habitat		5.74			0.57	Fish are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as birds (e.g., loons, grebes, cormorants, kingfisher).	WbirdFeed 10

Hydro Regime	0.21	AVERAGE(SatPct, Depth, DepthEven, PermWPct, Interspers, ThruFlo)	Hydro10
Structure	0.88	AVERAGE[Beaver, AVERAGE(Wettype, Shade, WoodAbove, ABpct, AqCov)]	Struc10
Productivity	0.33	AVERAGE(InletOutlet, GroundW, NewWetland, Wettype, Conduc, Karst, Nfix, Lake)	Produc10
Anoxia Risk	0.35	AVERAGE (OutDura, Depth, Warmth)	AnoxRisk10
Stressors	0.25	MIN(SedExcess, Acid, AltTime, ToxData, 1-NatVegCUpct)	Stress10

Function Score for Resident Fish Habitat	F	4.03	IF((Fish Access=0),0,
			IF((Water=0),0, ELSE:
			AVERAGE(HydroRegime, Structure, Productivity, AnoxiaRisk, Stress))

Benefits Score for Resident Fish Habitat	B	1.55	AVERAGE(Feeding Waterbird Habitat score, Fishing, PopDist, DistRd, Core)))

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Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	INV

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.40	Other factors being equal, wetlands closer to the coast tend to be more fertile due to deposition of airborne nutrients from marine waters. This potentially supports higher invertebrate numbers and perhaps diversity.	TidalProx8
		<100 m.	0	5	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				1.00	Macroinvertebrate and fish community composition is impacted beginning at about 5% impervious surface, a number that varies depending on the proportion of agricultural land as well (Waite et al. 2008). Comparing data from multiple regions, Utz et al. (2009) reported that aquatic invertebrates sensitive to impervious cover were generally lost when impervious cover was in the range of 3% (most sensitive taxa) to 23%.	ImpervCA
		<10%.	1	3	3			
		10 to 25%.	0	2	0			
		>25%.	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	warmth8
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to	0			0.00	Plants are more productive at warmer soil or sediment temperatures, and this supports higher productivity of aquatic insects.	karst8
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Many invertebrate groups (e.g., snails, isopods, lumbricid worms) cannot tolerate acidic conditions of bogs, and invertebrate richness generally tends to be greater in persistently inundated fens than in less persistently inundated marshes with more mineral soils (Holmquist et al. 2011). Marshes along lakes and rivers tend to have water longer into the growing season than other marshes and can support high abundance and diversity of invertebrates. One study reported that bogs and fens did not differ significantly with regard to invertebrate faunas. Dragonflies seemed to respond to the habitat's form and structure more than to its acidity or nutrient levels (Cannings & Cannings 1994)	Wettype8
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	2	2			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type				0.00	Because different wetland types are likely to support different species assemblages and many of those species may require complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	Subtypes8
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0.17			0.17	On a per-surface-area basis, deciduous trees and shrubs often support higher levels of insect biomass than conifers, at least among nocturnal flying insects (Ober and Hayes 2008). *In calculations, is excluded automatically (cell goes blank) if few or no trees in the wetland. Score is based on the maximum cover of any of the 3 woody deciduous height classes, adjusted to the 0-1 scale.*	DecidTree8
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Woody vegetation adds vertical habitat space, bark, and dead wood used by many invertebrates, whereas herbaceous vegetation has generally greater annual productivity. A well-interspersed even mix of both is hypothesized to maximize invertebrate diversity and productivity. In calculations, is excluded automatically (cell goes blank) if few or no trees or shrubs are present.	WoodHerb Mix8
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides food, cover, and a stable microclimate for many invertebrates that live in soil and peat of wetlands that seldom flood. In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation in the wetland. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is*	WoodDown 8
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F9	N Fixers	Nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, other legumes) comprise:				0.25	Leaves of nitrogen-fixing plants such as alder have been shown to support higher densities and richness of aquatic and terrestrial invertebrates (Wipfli et al. 2007, Wipfli & Musselwhite 2004, Hernandez et al. 2005, LeSage et al. 2005).	Nfixers8
		<1% of the shrub cover and <1% of the ground cover, or trees are the only cover.	0	0	0			
		1-25% of the shrub cover (if shrubs/trees are the dominant cover) or 1-25% of the ground cover (if herbaceous plants are the dominant cover).	1	1	1			
		25-50% of the shrub cover (if shrubs/trees are the dominant cover) or 25-50% of the ground cover (if herbaceous plants are the dominant cover).	0	2	0			
		50-75% of the shrub cover (if shrubs/trees are the dominant cover) or 50-75% of the ground cover (if herbaceous plants are the dominant cover).	0	3	0			
		>75% of the shrub cover (if shrubs/trees are the dominant cover) or >75% % of the ground cover (if herbaceous plants are the dominant cover).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Vegetation provides more food and cover to invertebrates than do bare areas, so invertebrate density and diversity is typically greater.	Gcover8
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Greater microtopography implies greater heterogeneity of water, vegetation, and disturbance regimes, which together should indicate higher capacity to support a wide variety of invertebrates.	Girreg8
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	The second condition implies greater diversity of plants, which sometimes is associated with greater diversity of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if no exposed herbaceous vegetation in the wetland.*	HerbDiv8
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.33	The larvae of many wetland invertebrates require surface water, so the absence or scarcity of that limits aquatic invertebrate richness.	SatPct8
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	2	2			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.25	Wetlands in which surface water persists longer are capable of supporting a wider variety of invertebrates, e.g., those that require many months or years to complete their life cycle, as well as those that mature more rapidly. Thus, wetlands with a proportionately large extent of persistent water may benefit a wide range of aquatic invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct8
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	4	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				1.00	The parts of a wetland that are inundated only seasonally may contain water long enough for many invertebrates to complete their life cycle, while providing fresh food resources (e.g., plant litter). They also tend to be shallower and less deficient in dissolved oxygen, making them suitable for a wider range of species. Seasonal fluctuations release nutrients bound up in wetland sediments, and stimulate the growth of new plants whose seeds have been dormant. However, some invertebrate taxa, such as those without winged adult stages living in isolated wetlands (bog pools), may not survive prolonged desiccation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasPct8
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Dynamic water levels in wetlands with outlets usually imply more productive wetlands and greater export of organic matter, whereas stable water levels typically imply less export. However, if water level fluctuations are too severe (e.g., greater than plant height) production of organic matter can diminish. Also, more stable water levels may benefit aquatic invertebrates in regions where many streams and wetlands are prone to sudden fluctuations from melting snow and storms. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluc8
		<10 cm change (stable or nearly so).	0	3	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				1.00	Provided that they hold surface water for several weeks, shallow areas support greater primary production, support higher vascular plant densities, and consequently greater invertebrate production. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth8
		<10 cm deep (but >0).	0	3	0			
		10 - 50 cm deep.	1	5	5			
		0.5 - 1 m deep.	0	4	0			
		1 - 2 m deep.	0	2	0			
		>2 m deep. True for many fringe wetlands.	0	1	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.00	Different invertebrate groups thrive at different water depths in boreal wetlands (Corcoran et al. 2009). Thus, a variety of depths may promote greater invertebrate richness for the wetland as a whole. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthDiv8
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	1	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	0	1	0			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.25	Many wetland invertebrates reach their greatest density in ponded areas. That is partly because the isolation protects them from predation by fish that normally inhabit the channels (Hornung & Foote 2006). Flowing water in channels favours different invertebrate assemblages, which when combined with the contribution of pools, adds to the overall diversity of the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet8
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Emergent and submerged vegetation typically hosts extensive growths of epiphytic algae, which along with the supporting herbaceous plants, provide food and cover for a wide variety of invertebrates. Intermediate cover conditions allow more light penetration of the water column, higher algal productivity, greater oxygenation, and thus tend to support a wide variety of invertebrate groups. *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct8
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	2	0			
		100% of the ponded water.	0	0	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Greater invertebrate diversity overall may be supported by wetlands with a relatively even mix of open water and vegetation, interspersed throughout. Such conditions reflect a variety of light, temperature, and oxygen regimes as well as edge habitats (ecotones) that together provide more niches for invertebrates. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers8
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					The importance of large wood to aquatic life has been widely documented in perennial streams (literature reviewed by Murphy 1995, May 2003, Wenger 2000, Knutson and Naef 1997) and in lakes (Roth et al. 2007). Many aquatic invertebrates attach to submerged wood and feed on algae and leaves associated with it. Constructed wetlands to which woody debris is added may support greater biomass or richness of several aquatic invertebrate groups (e.g., Alsfeld et al. 2009). Most instream wood originates in the parts of the riparian areas that are within 100 ft of a stream (McDade et al. 1990, Van Sickle & Gregory 1990, Robison & Beschta 1990, Meleason et al. 2003). *In calculations, is excluded automatically (cell goes blank) if wetland never has open surface water during an average year.*	AqCov8
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F46	Throughflow Resistance	During its travel through the AA at the time of peak annual flow, water arriving in channels: [select only the ONE encountered by most of the incoming water].				0.50	Diffuse flow paths and large spatial complexity of channels within a wetland support a wider variety of microhabitats for invertebrates, so should result in greater species richness. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year or if no surface inflows.*	ThruFlo8
		Does not bump into many plant stems as it travels through the AA. Nearly all the water continues to travel in unvegetated (often incised) channels that have minimal contact with wetland vegetation, or through a zone of open water such as an instream pond or lake.	0	0	0			
		Bumps into herbaceous vegetation but mostly remains in fairly straight channels.	1	1	1			
		Bumps into herbaceous vegetation and mostly spreads throughout, or is in widely meandering, multi-branched, or braided channels.	0	2	0			
		Bumps into tree trunks and/or shrub stems but mostly remains in fairly straight channels.	0	1	0			
		Bumps into tree trunks and/or shrub stems and follows a fairly indirect path from entrance to exit (meandering, multi-branched, or braided).	0	2	0			
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				0.50	In general, non-saline waters with greater TDS or conductivity are more fertile, are better-buffered against large changes in acidity, and potentially produce greater biomass of aquatic invertebrates. *In calculations, assigned score of 0 if TDS>2000 mg/L or conductivity>4000 µS/cm. Otherwise, is assigned score of 1 if TDS>300 mg/L or conductivity is >600 µS/cm. All other conditions are assigned a score of 0.5.*	Conduc8
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Groundwater provides a relatively steady input of nutrients (e.g., Morley et al. 2011). That can support greater algal production and consequently greater invertebrate production and perhaps diversity. It also provides relatively warm temperatures and helps sustain low flows, thus increasing annual production of invertebrates (Brown et al. 2007). However, where underlying geologic strata are iron-rich, groundwater discharge is often accompanied by precipitation of iron "floc" in wetland sediment, smothering aquatic invertebrates and reducing their diversity. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	Groundw8
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	Comparing data from multiple regions, Utz et al. (2009) reported that once urbanization in a watershed reached 60%, all taxa remaining responded either neutrally or positively with respect to continued urbanization. Most were harmed at much lower levels. The importance of streamside vegetation, especially trees, for sustaining the health of aquatic systems has been documented in the Pacific Northwest (e.g., Gregory et al. 1991, Naiman et al. 2000, Richardson et al. 2005, Wipfli et al. 2007). The positive effect is partly because wood falling into streams increases channel complexity which benefits aquatic invertebrates and fish; that may not apply to wood falling into wetlands. Trees also help maintain stream temperature and streams adjoined by natural vegetation support richer and healthier aquatic invertebrate communities (Richards et al. 1996). However, the effects of buffers and/or tree canopy closure on aquatic life in perennial streams vary, with some studies showing little effect on native fish (Roy et al. 2005, Fischer et al. 2010) and others a positive effect especially when buffer width was at least 100 ft (Frimpong et al. 2005, Horwitz et al. 2008). A 30-ft wide buffer along perennial streams in British Columbia was found to be insufficient to protect stream invertebrate communities from adverse effects of clear-cut logging, although the terrestrial insects the buffer provided were noted as a potentially important food source for fish using the streams (Hoover et al. 2007). Another study of BC perennial streams found uncut riparian buffers of at least 30 ft were needed to limit changes from clear-cut logging to aquatic life in headwater forested watersheds; those changes included increase abundance of aquatic invertebrates and algae (Kiffney et al. 2003). Increased sunlight from vegetation removal can increase stream and wetland productivity and thus the density of some invertebrate groups, where nutrients and elevation (stream temperature) are not severely limiting (Moldenke & Linden 2007).	NatVegPctC8
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Unvegetated uplands provide the least refuge for emerging aquatic insects, and also are most likely to contribute contaminants and disturb runoff patterns. Agricultural land cover seemed less impacting than impervious cover. Most organisms were capable of tolerating high levels of agricultural land cover, but a few disappeared when agricultural land cover exceeded 21% of the watershed area. *In calculations, is excluded automatically (cell goes blank) if F52 was answered positively.*	CUbuffLUtyp8
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	Life histories of most invertebrates are closely linked to specific thermal and light (seasonality) conditions as those interact with specific hydrologic patterns. Abnormal patterns of inundation to which invertebrate communities are not adapted may reduce populations of many intolerant invertebrate species and in some cases diminish local biodiversity (Bunn & Arthington 2002).	AltTime8a

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.75			0.25	Aquatic invertebrate communities (both benthic and planktonic) are harmed by excessive sedimentation and turbidity from sediment runoff. Sediment from timber-harvest activity (clearings and roads) can intensify the turbidity effects of spawning-salmon disturbance on macroinvertebrates. The deposition of fine sediment can limit populations of grazing invertebrates even when algal foods become more available following timber harvest (Kiffney & Bull 2000).	SedCA8a
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	Many wetland invertebrates inhabit the soil, and potentially are harmed by soil disturbance such as from tillage or compaction.	SoilDisturb8a

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
	Function Score for Anadromous Fish					0.00	Aquatic invertebrates are especially valued in food webs when the same wetland's structure also strongly supports important consumers such as fish, bats, and birds (Baxter et al. 2005, Gende & Wilson 2001, Christie & Reimchen 2008).	
	Function Score for Resident Fish Habitat					0.40		
	Function Score for Amphibian Habitat					0.56		
	Function Score for Feeding Waterbird					0.57		
	Function Score for Nesting Waterbird					0.57		
	Function Score for Songbird, Raptor, & Mammal Habitat					0.85		

Structure	0.63	AVERAGE [ABpct, AVERAGE(AqCov, WoodHerbMix, HerbDiv, Gcover, WoodDown, Girreg)]	Structure8
Hydroperiod	0.65	AVERAGE [PermWpct, SatPct, SeasPct, Fluctu,GroundW)]	Hydropd8
Connectivity		AVERAGE(Interspers, ThruFlo, IsoWet)	Connec8
Productivity	0.51	AVERAGE [WetType, AVERAGE(Depth, Warmth, DecidTree, Hardwood, WoodDown, Nfixers, Conduc, TidalProx, Karst)]	Food8
Landscape	0.67	AVERAGE(Imperv, NatVegPctCU, CUbuffLUtype, Subtypes)	Lscape8
Stressors	0.56	AVERAGE(AltTime, SedCA, SoilDisturb)	Stressors8

Function Score for Aquatic Invertebrate Habitat	F	5.85	AVERAGE [Struc, Productivity, AVERAGE(Hydropd, Connec, Stressors, LScape]
Benefits Score for Aquatic Invertebrate Habitat	B	4.94	AVERAGE(AnadFish, ResFish, Amphib, WbirdF, WbirdNest, SongbMam)

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Amphibian & Turtle Habitat		The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	AM					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.75	Larger contiguous tracts of nearby natural land, especially natural forest land, are more likely than small or fragmented patches to meet the habitat needs of dispersing and summering amphibians (Cushman 2006). Some New Brunswick data indicate tree plantations may be less suitable than natural forest for amphibians (Waldick et al. 1999), and clearcuts in Maine were found to be unsuitable even when logs and other coarse material was retained (Popescu et al. 2012).	NatVegSize11
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	0	3	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		100 to 1000 hectares.	1	6	6			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				1.00	Amphibians require upland habitat as well as aquatic habitat (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially natural forest within 1 km, usually provide the most suitable microclimates and habitat structure (Mazerolle et al. 2005, Baldwin et al. 2006a). Unvegetated or artificially vegetated areas, such as clearcuts and tree plantations (Waldick et al. 1999, Patrick et al. 2006), can inhibit movements of some species within upland habitats and reduce population viability. When radiotracked frogs on Vancouver Island were released inside clusters of trees amidst otherwise unsuitable habitat (clearcuts), the proportion of frogs abandoning the tree cluster was greater the smaller the cluster. Frogs were less likely to leave tree patches intersected by a running stream or where neighborhood stream density was high. Scattered tree patches of at least 1 ha, preferably in stream locations, were the minimum needed to allow normal overland passage of one frog species (Chan-McLeod & Moy 2007). The amount of forest surrounding a wetland is a strong positive predictor of amphibian richness and/or abundance (Findlay & Houlahan 1997), even more so than the amount of other surrounding wetlands (Quesnelle et al. 2015). However, on Prince Edward Island, no evidence was found to suggest that patch area or perimeter affects amphibian species richness (Silva et al. 2003).	NatVegProx11
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	7	7			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.80	See above.	NatCov2mi11
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	2	0			
		20 to 60% of the land.	0	3	0			
		60 to 90% of the land.	1	4	4			
		>90% of the land. SKIP to OF10.	0	5	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type of non-natural land cover that surrounds a wetland can influence dispersal success of amphibians. Unvegetated lands are usually the least suitable. Clearcuts may be better but perhaps still not as suitable as natural cover on soils of similar productivity (Waldick et al. 1999).	ScapeLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Roads and/or traffic are a significant barrier to or hazard for dispersing amphibians, as demonstrated both in this region (Mazerolle 2004, Maxerolle & Desrochers 2005, Mazerolle et al. 2005, Jacobs & Houlahan 2011, Gravel et al. 2012) and elsewhere (Mader 1984, Fahrig et al. 1995, and see review by Fahrig & Rytwinski 2009). Roads with as few as 10 vehicles per hour can still have significant amphibian roadkill (Mazerolle 2004). Even some narrow logging roads that had long been abandoned continued to impair movements and densities of salamanders in North Carolina; the road effect appeared to extend about 35 m into the adjoining woods on both sides of the road (Semlitsch et al. 2007).	RdDis11
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	7	7			
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	During certain times of their life cycle, frogs, turtles, and salamanders must move from their breeding wetlands into other wetlands or uplands with natural vegetation (Patrick et al. 2007, 2008). Pavement and other open surfaces act as barriers to these essential movements, and individuals that do attempt to cross roads are often crushed by vehicles (see above). In Ontario (Eigenbrod 2008a) and Virginia (Marsh 2007), "accessible habitat" -- defined as the habitat available to pond-dwelling amphibians without individuals needing to cross a major road -- was a better predictor of amphibian species richness than simply the amount of habitat within some distance of breeding ponds (Eigenbrod 2008b).	RoadCirc11
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.71	In this region, amphibians have been shown to occur more frequently in wetlands located close to other wetlands, or with a large number of other wetlands in close proximity (Stevens et al. 2002, Mazerolle et al. 2005, Jacobs & Houlahan 2011). That is because many species in these groups move regularly among wetlands in order to meet different life history needs (Gibbs 1993).	PondProx11
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	1	5	5			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					High levels of these substances, such as from livestock use or wastewater effluent, can harm amphibian populations and reduce amphibian diversity, e.g., Schmutzer et al. 2008). In calculations, the indicator score is set to 0 if those contaminants are present within the AA, is set to 0.2 if within 1 km and connected, is set to 1 if sampling shows no problems, or is set to blank (indicator is ignored) if data are insufficient.	Toxic11
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF25	Aspect	The overland flow direction of most surface water (in streams, rivers, or runoff) that enters the AA is:				0.67	Because amphibians and reptiles do not physiologically regulate their body temperatures and some are at the northern limit of their range in this region, it can be assumed that they may favour warmer microhabitats overall. Wetlands fed by water from south-facing slopes would be expected to be warmer, but the possible effect on amphibians has not been widely tested.	Aspect11
		Northward (N, NE). north-facing contributing area.	0	1	0			
		Southward (S, SW). south-facing contributing area.	0	3	0			
		Other (E, SE, W, NW), or no detectable uphill slope or input channel (flat).	1	2	2			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Amphibians do not physiologically regulate their body temperature. Thus their populations are likely to be more productive (and have greater survival) in warmer parts of the region.	_GDD11
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true]:					Populations of some amphibians seem to thrive best in fishless wetlands. In some regions, predatory fish (especially, exotic species) severely reduce populations of native species (Pearl et al. 2005). *In calculations, if wetland is fishless it is scored as a 1 but if fish present this indicator is ignored in model calculations.*	FishAcc11
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	0	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	0	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	0	0			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	1	0			
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			0.00	Areas of calcareous bedrock (karst landforms) tend to have more naturally-formed crevices and tunnels that could provide cover for amphibians during their terrestrial phases. Karst also tends to support higher aquatic productivity. *In calculations, the 0-3 category is first divided by 3.*	Karst11
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Marshes and fens are most likely to provide favored breeding habitat (e.g., Houlahan & Findlay 2003) andt many swamps contain important vernal breeding pools as well as providing excellent cover for dispersing adults. Some swamps in floodplains, however, have water levels that are too dynamic to support breeding by some amphibian speces.	Wettype11
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	1	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	2	2			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	2	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of amphibian species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv11
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					During certain months of the year many salamanders and some frogs and toads require the moist microclimate and abundant invertebrate foods found in or under large downed wood in the uplands surrounding wetlands. Forests with large-diameter trees are most likely to have such conditions and in this region, American bullfrog and mink frog are more likely to occur in wetlands with nearby mature and overmature forest (Jacobs & Houlahan 2011). The dominant type of vegetation, both near a stream and in a watershed generally, also has the potential to strongly influence aquatic productivity (Ball et al. 2010) and thus tadpole survival, with deciduous vegetation usually indicating greater nutrient and light availability. However, one survey in this region found fewer amphibian species in wetlands surrounded by hardwood (deciduous) forest (Jacobs & Houlahan 2011). The formula used here gives equal weight to the variety of classes and increasing mean diameter. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present.*	TreeVar11
		coniferous, 1-9 cm diameter and >1 m tall.	0	1	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	1	0			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	2	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	3	0			
		coniferous, >40 cm diameter.	0	4	0			
		broad-leaved deciduous >40 cm diameter.	0	4	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Interspersion of a balanced mix of concealing woody cover and warmer more food-rich openings of herbaceous vegetation probably provides optimal terrestrial habitat for most amphibians and turtles.	WoodHerbMix11
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides food, cover, and a stable microclimate for many salamanders (Patrick et al. 2006) as well as frogs and toads that move between wetlands (Freedman et al. 1996) but its presence may not be enough to offset broader changes in land cover (Popescu et al. 2012). *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown11
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.67	Although many amphibians may benefit from warmer temperatures associated with sparser ground cover within a wetland, dense ground cover provides better protection from predators (Mazerolle & Desrochers 2005). Thus, intermediate levels are scored highest.	Gcover11
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	2	2			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	3	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Complex microtopography provides many suitable microclimates important to survival of adult amphibians during the late summer, fall, and winter.	Girreg11
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					To meet all their life history requirements, most amphibians require uplands in close proximity to, or interspersed within, suitable wetlands.	Inclus11
		Few or none.	1	1	1			
		Intermediate (1 - 10% of vegetated part of the AA).	0	2	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	3	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				0.75	Although shade provided by wider buffers is beneficial to many aquatic species, populations of a few species of native frogs, pond-breeding salamanders, and aquatic invertebrates sometimes increase following partial removal of woody cover. Gaps in woody cover imply less shading and thus warmer water temperatures and algae, increasing aquatic productivity as long as sediment inputs do not increase greatly at the same time (Murphy et al. 1981, Hawkins et al. 1983). *In calculations, is excluded automatically (cell goes blank) if little or no woody vegetation is present.*	ShrubSun11
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	1	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	1	3	3			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.33	Wetlands that contain at least a little surface water support breeding amphibians, but even those that lack surface water throughout the year may still provide dispersal sites for adult frogs, toads, and salamanders.	SatPct11
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	5	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	6	0			
		25-50% of the AA never contains surface water.	0	4	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	2	2			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	1	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.67	Surface water that persists for all or nearly all of the year provides reproductive as well as feeding and overwintering habitat for most amphibian species (Baldwin et al. 2006a). However, risk of fish predation may be greater in some persistently inundated wetlands if they are fish-accessible. Ideally, a wetland should exist as part of a mosaic of wetlands with different water regimes (Gibbs 1993). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct11
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				0.80	Egg masses of many frogs and aquatic salamanders are more susceptible to stranding in wetlands with large water level fluctuations. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu11
		<10 cm change (stable or nearly so).	0	5	0			
		10 cm - 50 cm change.	1	4	4			
		0.5 - 1 m change.	0	3	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Pools that remain isolated from other surface waters even during high water provide amphibians with the most protection from predatory fish. More amphibian species prefer ponded water than water flowing in channels. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet11
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					The eggs and larvae of many frogs and aquatic salamanders can easily be harmed by excessive ultraviolet radiation. Aquatic plants may provide some degree of shelter from such radiation, as well as providing attachment surfaces for eggs. However, one survey found that, among wetlands in this region, amphibian richness increased with increasing open water area (Stevens et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct11
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	3	0			
		30-70% of the ponded water.	0	3	0			
		70-99% of the ponded water.	0	1	0			
		100% of the ponded water.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider bands of wetland vegetation help protect a wetland's open waters from contaminants carried in from adjoining uplands. Wider bands of wetland vegetation also provide better cover for young frogs and salamanders as they transition to upland nonbreeding areas. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth11
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Unshaded open water areas potentially provide warmer conditions favoured by many amphibians, while nearby areas with cover provide protection from predators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers11
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F39	Non-vegetated Aquatic Cover	During most of the growing season and in waters deeper than 0.5 m, the cover for fish, aquatic invertebrates, and/or amphibians that is provided NOT by living vegetation, but by accumulations of dead wood and undercut banks is:					Large woody debris helps protect frogs and aquatic salamanders from aerial predators, and provides important basking sites. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or no open water.*	WoodAbove11
		Little or none.	0	0	0			
		Intermediate.	0	1	0			
		Extensive.	0	2	0			
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Under many circumstances, a pH of less than about 4.5 inhibits reproduction and growth of most amphibians (Freda 1986). However, a survey of 159 Nova Scotia wetlands and ponds found green frog tadpoles in a wetland with pH 3.9, and six of 11 amphibian species were found in at least one wetland with a pH of less than 4.5 (Dale et al. 1985). Wood frogs appeared to be the most acid-tolerant, overall. *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acidic11
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F50	Groundwater Strength of Evidence	Select first applicable choice:					Wetlands with substantial groundwater inputs tend to have more stable and reliable water levels, thus increasing the likelihood of amphibians breeding successfully. Also, winter water temperatures are warmer than most receiving surface waters. However, the cooler temperatures in summer associated with groundwater input may be less favourable to development of some amphibians. *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx. Otherwise is rated based on response in column D.*	GroundW11
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	3	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	2	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.80	To meet all their life history requirements in this region, most amphibians require other wetlands and uplands in close proximity to, or interspersed within, suitable breeding wetlands (Baldwin et al. 2006b). Uplands that are dominated by natural vegetation, especially forest (Stevens et al. 2002), usually provide the most suitable microclimates and habitat structure. To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts et al 2005). Buffers narrower than 100 m will not protect most amphibian populations (Powell & Babbitt 2015).	NatVegPct11
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	This indicator is similar to the one above but focuses specifically on the type of unsuitable land cover closest to the wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLU11
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Increased visitation by humans and pets can potentially increase the spread of aquatic fungi that are lethal to many amphibians.	Core1_11
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2_11
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Excessive human traffic and free-roaming pets can harm native amphibians directly (collecting and predation) and indirectly (habitat alteration), so measures to reduce such impacts are given credit.	BMP11
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0			0.56	Amphibians are highly sensitive to many contaminants. These include road salt (Collins & Russell 2009), which is not necessarily diluted by spring rains to harmless levels (Karraker & Gibbs 2011).	ToxicIn11

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of amphibians on a wetland (and thus its importance) increases if no other natural vegetation of comparable type and extent is available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	0		0	0.00	See above.	WoodyUniq
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of amphibians on a wetland (and thus its importance) increases if no other wetlands or ponds are in the vicinity.	DistPond10
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	1	1	1			
		50-500 m, but separated by those features.	0	1	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to amphibian biodiversity at a regional scale.	RareHerp
	Function Score for Feeding Waterbird Habitat					0.57	Amphibians are especially valued when the same wetland's structure also strongly supports important consumers such as waterbirds (e.g., herons) and mammals which prey upon them.	WBFscore10
	Function Score for Songbird, Raptor, & Mammal Habitat					0.85		SBMscore10

Hydro Regime	0.45	AVERAGE(Fluctu, SatPct, PermWpct, ISOwet)	Hydro11
Aquatic Structure		AVERAGE(ABpct, WoodAbove, Interspers, Vwidth)	AqStruc11
Terrestrial Structure	0.48	AVERAGE(WoodHerbMix, WoodDown, ShrubSun, Gcover, Girreg, Inclus, WetTypeDiv)	TerrStruc11
Productivity	0.26	AVERAGE(Aspect, GDD,TreeVar, GroundW, Karst)	Produc11
Landscape	0.45	AVERAGE[RoadCirc, AVERAGE(NatVegPct, BuffLU, NatVegProx, NatCov2mi, ScapeLU, NatVegSize)]	Lscape11
Waterscape	0.71	PondProx	Waterscape 11
Stressors (lack of)	0.91	AVERAGE(FishAcc, AVERAGE(RdDis, Toxic, Core1, Core2, BMP)	Stress11

Function Score for Amphibian Habitat	F	5.60	AVERAGE [(Wettype, Hydro, AVERAGE(AqStruc, TerrStruc, Produc, Lscape, Waterscape, Stress)]
Benefits Score for Amphibian Habitat	B	5.87	IF((RareHerp=1),1, ELSE: AVERAGE(WBFscore, MAX(HerbUniq, WoodyUniq, DistPond), SBMscore)

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Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	WBF

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.50	Larger wetlands are used disproportionately by feeding waterbirds. Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex.	AreaTotal12
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	4	4			
		1 to 10 hectares.	0	5	0			
		10 to 100 hectares.	0	6	0			
		>100 hectares.	0	8	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.67	Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Although they will fly much farther than 1 km to reach other wetlands and water bodies (Haig et al. 1998), 1 km is used as a practical distance for identifying such features in aerial images.	PondProx12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	1	4	4			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:				0.40	Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is because they provide greater buffer against predators, are more likely to have productive fish populations, and are sufficiently long for waterbird species that cannot take flight by leaping directly upward.	BigPondProx12
		<100 m.	0	5	0			
		100 m - 1 km.	0	4	0			
		1 -2 km.	0	3	0			
		2-5 km.	1	2	2			
		5-10 km.	0	1	0			
		>10 km.	0	0	0			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.22	Wetlands with maritime climate are more likely to have conditions favourable to feeding and wintering waterbirds in this region. Many migratory waterbirds in the Maritimes follow a coastal route. Some non-tidal marshes (such as many dyked fields) that are within a few kilometers of tidal mudflats support large numbers of roosting migratory shorebirds.	TidalProx12
		<100 m.	0	9	0			
		100 m - 1 km.	0	7	0			
		1 - 5 km.	0	6	0			
		5-10 km.	0	4	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term. This indicator denotes potential or actual exposure.	_Tox12
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Warmer mean annual temperature implies higher aquatic productivity and a longer period during which surface waters remain ice-free and thus usable by waterbirds.	Warmth12
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Especially during migration, the diversity of waterbirds may be greater in wetlands with fish because many wetland birds (e.g., loons, herons) feed extensively on fish. *In calculations, receives maximum indicator score if wetland has fish, but if fish absent, this indicator is ignored.*	Fish12a
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	1	1			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	0	0			
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Most feeding waterbirds are naturally drawn to more productive wetlands, which tend to be marshes, especially those along rivers and lakes (Thormann & Bayley 1997, Epners et al. 2010). A lack of surface water in bogs and swamps makes them less suitable for most waterbirds.	Wettype12
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	2	2			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of feeding waterbird species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv12
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F15	Shorebird Feeding Habitats	During any 2 consecutive weeks of the growing season, the extent of mudflats, bare unshaded saturated areas not covered by thatch, and unshaded waters shallower than 6 cm is: [Include also any area that is adjacent to the AA.]				0.00	Mudflats and seasonally inundated shortgrass flats (including farmed wetlands, Taft & Haig 2005) are important to large numbers of migratory waterbirds.	Mudflat12
		None, or <100 sq. m.	1	0	0			
		100-1000 sq. m.	0	2	0			
		1000 – 10,000 sq. m.	0	3	0			
		>10,000 sq. m.	0	4	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				1.00	Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008).	EmPct12
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	0	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	1	5	5			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0				Fringe wetlands are often used by more wetland birds partly because the adjoining wide expanses of open water can provide refuge from disturbances as well as additional foods. *In calculations, presence increases the score but absence has no effect, and is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Fringe12
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0			0.00	Larger water bodies such as lakes tend to attract higher densities of waterbirds, other factors being equal (e.g., Savard et al. 1994).	Lake12a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.20	Although wetlands that never contain surface water may still be visited by feeding waterbirds, they are used by fewer species.	SatPct12
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded	1	1	1			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.33	Surface water that persists for all or most of a year provides more feeding opportunities for wetland birds. If no surface water persists throughout a year, waterbird use of the wetland for feeding can still be substantial if the wetland borders a lake, large river, or estuary. Areas that are flooded only seasonally can be very productive when flooded. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct12
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	0	0			
		1-20% of the AA.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA. True for many fringe wetlands.	0	2	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				1.00	Wetlands that flood only seasonally tend to be more productive and are immensely important as feeding and resting areas for migratory waterbirds. Occasional severe flood or drought can rejuvenate wetland productivity, and thus waterbird feeding opportunities, by stimulating release of nutrients from sediments or soil. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct12
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	3	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Shallower water depths support greater aquatic productivity and thus are attractive to many feeding waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth12
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.00	Different waterbird species prefer feeding in different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of feeding birds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 12
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	1	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	0	1	0			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds feed more in ponded areas than along channels. Especially at times of high water in channels, off-channel ponded areas provide refuge for many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoWet12
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					For most waterbirds, intermediate proportions of open ponded water and vegetation appear to provide the best protection from predators and the elements, as well as the richest feeding opportunities (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	ABpct12
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	2	0			
		5-30% of the ponded water.	0	5	0			
		30-70% of the ponded water.	0	7	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Aquatic plant cover and the abundant invertebrates it supports are favored by many waterbird species. Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods, and waterbird use of such wetlands is usually significantly greater (Longcore et al. 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers12
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				These plants usually indicate highly enriched conditions, and those tend to be more productive feeding areas for most waterbird species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year. In calculations, is counted as a positive if present but does not decrease score if absent*	Algae12
F47	pH Measurement	The pH in most of the AA's surface water:				1.00	Food availability for most waterbird species in this region is greatest in wetlands whose pH is >7.5 (basic pH) and significantly less where pH is less than about 6.5 (Hanson & Calkins 1996). *If pH is <4, the indicator score is set to 0, or is set to 0.5 if the pH is between 4 and 7.5 or if water is darkly tea-coloured. Otherwise, score is set to 1.*	Acid12
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver are a key driver for increasing and maintaining open water area throughout a region (Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver12
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope and riverine wetlands.	Gradient12
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core12a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core12b
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Frequent traffic by people and free-roaming pets can stress some waterbirds, so measures to reduce such impacts are given credit.	BMP12

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq12
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.25	If they attract waterbirds, wetlands closer to settled areas may also attract greater bird-centered use by humans (e.g., birdwatching, hunting) thus increasing their value.	PopCtr12
		<100 m.	0	4	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond12
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	1	1	1			
		50-500 m, but separated by those features.	0	1	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare12
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Such areas have been chosen through a systematic selection process by biologists and birders in each state.	Ibird12v
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	Human enjoyment of waterbirds (birding, hunting) is facilitated where wetlands are largely visible from major access points. This increases the value of any level of feeding waterbird function.	Visib12
		<25%.	0	0	0			
		25-50%.	0	1	0			
		>50%.	1	2	2			
F64	Consumptive Uses (Provisioning Services)	Waterfowl hunting.	0			0.00	A direct (but hardly the only) indicator of value, at least for some species.	Duckhunt

Hydro Regime	0.33	AVERAGE(ISOwet, SatPct, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro12
Structure	0.75	AVERAGE[Interspers, AVERAGE(ABpct, EmPct), AreaTotal]	Struc12
Productivity	0.42	AVERAGE(Wettype, Acidity,Warmth, Fringe, Lake, Fish, Algae, TidalProx, Gradient)	Produc12
Landscape	0.52	IF((Fen+Marsh=0), blank, ELSE: AVERAGE(WetTypeDiv, Beaver, PondProx, BigPondProx)	Lscape12
Stressors (lack of)	1.00	AVERAGE(Corea, Coreb, BMP, _Tox)	Stress12

Function Score for Feeding Waterbird Habitat	F	5.74	IF((AllSat1=1),0,
			IF((TooSmall=1),0, IF((TooSteep=1), 0, ELSE:
			[AVERAGE(Lscape,Stressors, Produc) + 2*MAX(Mudflat, AVERAGE(Hydro, Struc)] /3

Benefits Score for Feeding Waterbird Habitat	B	4.17	IF((Rare=1),1, IF((IBirdv=1),1, MAX(HerbUniq, DistPond, AVERAGE(DuckHunt, PopCtr, Visib))))

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Waterbird Nesting Habitat		The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	WBN					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.43	Larger wetlands in this region are used disproportionately by nesting waterbirds (Gibbs et al. 1991, Stevens et al. 2003). Smaller identical wetlands of equal cumulative area probably support lower numbers and cumulative richness of feeding waterbirds, unless they are close together in a complex. Larger areas also are preferred by many waterbird species as roosting or molting sites, because they provide greater buffer against predators. Larger wetlands also are more likely to have productive fish populations, and may be sufficiently long for some waterbird species (e.g., cormorants, loons) that require lengthy areas when taking flight.	SizeHerbac 13
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Road corridors are often followed by ravens and mammals that prey on waterbird eggs and young, and fledglings are vulnerable to collisions with vehicles.	RdDis13
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	3	0			
		50 - 100 m.	0	4	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	8	8			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.67	Waterbirds prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can fly to alternate sites that serve as refuge and which may provide different but complementary water regimes and foods. Corridors can be important to ducks that must walk overland with their young to find other wetlands in which to feed or molt. Nesting waterbird richness in this region is depressed more by isolation when that occurs in small than in large wetlands (Gibbs et al. 1991).	PondProx13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	1	4	4			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:				0.00	Larger ponded areas are preferred by swans, loons, grebes, cormorants, and some other waterbird species. That is partly because they provide greater buffer against predators, are more likely to have productive fish populations, and are long enough for waterbird species that cannot take flight by leaping directly upward (Stevens et al. 2003). Duckling survival is also greater in or near large ponded water bodies, provided they also have adequate cover. However, motorboat use is greater in some larger water bodies and the disturbance can affect waterbird breeding success.	LakeProx13
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 -2 km.	0	4	0			
		2-5 km.	1	3	0			
		5-10 km.	0	2	0			
		>10 km.	0	0	0			
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					Contaminants in food webs are detrimental in the long term.	Toxics13
		The condition is present within the AA.	0					
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0					
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing waters.	0					
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1					
OF28	Fish Access or Use	According to agency biologists and/or your own observations, the AA. [Mark just the first choice that is true.]:					Breeding density of some waterbirds can be twice as great in fishless lakes than in lakes with fish, after accounting for lake area, and some species occur almost exclusively in fishless lakes due to greater abundance of aquatic invertebrates upon which they feed (Epners et al. 2010). *In calculations, receives maximum indicator score if wetland has water but is fishless, whereas if fish are present, this indicator is ignored.*	Fish13A
		Is known to support rearing and/or spawning by Atlantic salmon or other anadromous species or eels. Go to Provincial Landscape Viewer>Wildlife>Significant Habitat>Species at Risk. Contact local fishery biologists, review the ACCDC report, and visit these websites:	0	1	0			
		Has not been documented to support Atlantic salmon rearing and/or spawning, but is connected to nearby waters likely to contain Atlantic salmon or other anadromous species or eels and is probably accessed by those during some conditions.	0	1	0			
		Is probably is not accessed by any anadromous fish species but is known or likely to have other fish at least seasonally.	1	1	1			
		Is known or likely to be fishless (e.g., too small, dry, and/or not accessible even temporarily, and not stocked).	0	2	0			
OF31	Black Duck Nesting Area	In Google Earth, open the KMZ file that accompanies this calculator, called BlackDuck. Adjust its alignment and opacity. Determine the predicted density (pairs per 25 sq. km) of nesting American Black Duck in the AA's vicinity: <10 (enter 0), 10-20 (enter 1), 20-30 (enter 2), >30 (enter 3). If outside of region shown in map, change to blank.					Although not applicable to all nesting waterbird species in this region, the models that predict suitable nesting habitat for black duck are likely to identify and map areas suitable for many. Black duck is a species that has declined in much of its historical range.	Bduck13
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.67	Waterbirds (e.g., black duck, Staicer et al. 1994) raise young most successfully in more productive wetlands, which tend to be marshes along rivers and lakes. However, many fens that contain ponded open water also are heavily used by some nesting waterbird species.	Wettype13
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in their adjoining column. Otherwise go to B below.						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	0	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	2	2			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	0	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	3	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					Large-diameter trees are more important because of their potential to provide rookeries for herons and nest cavities for a few waterbird species, e.g., hooded merganser. Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	TreeForm13
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	0	0			
		coniferous, 10-19 cm diameter.	0	0	0			
		broad-leaved deciduous 10-19 cm diameter.	0	0	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:					Snags provide nest cavities for a few waterbird species, e.g., wood duck, common goldeneye (Prince 1968). Such trees may be used even when located a considerable distance from the wetland. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagB13
		None, or fewer than 8/ hectare which exceed this diameter.	0	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	3	0			
		Several (>8/hectare) but above not true.	0	2	0			
F16	Herbaceous % of Vegetated Wetland	In aerial ("ducks eye") view, the maximum annual cover of herbaceous vegetation (all non-woody plants except moss) is:				1.00	Most waterbirds favor emergent herbaceous vegetation rather than woody vegetation, partly because it provides food as well as cover. Herbaceous rather than woody vegetation is the most attractive nesting cover for most species of waterbirds (Bolenbaugh et al. 2011), partly because it provides food as well as cover. Trees near water edges discourage use of those areas by some waterbird species, probably because it potentially conceals or provides a perch for predators such as eagles and falcons (Shepherd & Lank 2004, Sprague et al. 2008). Even tree-nesting species such as wood duck and goldeneye prefer nest sites with relatively open surroundings (Prince 1968).	EmPct13
		<5% of the vegetated part of the AA or <0.01 hectare (whichever is less). Mark "1" here and SKIP to F20 (Invasive Plant Cover).	0	0	0			
		5-25% of the vegetated part of the AA.	0	2	0			
		25-50% of the vegetated part of the AA.	0	3	0			
		50-95% of the vegetated part of the AA.	0	4	0			
		>95% of the vegetated part of the AA.	1	5	5			
F22	Fringe Wetland	During most of the year, open water within or adjacent to the vegetated part of the wetland is much wider than the maximum width of the vegetated zone within the wetland. Enter "1" if true, "0" if false.	0			0.00	Open water is important to a wide array of nesting waterbirds, and is most available in "fringe" wetlands. *In calculations, is excluded automatically (cell goes blank) if wetland never has persistent surface water during an average year.*	Fringe13
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				Lacustrine wetlands are especially attractive to nesting waterbirds, partly because of the variety of foods they provide, and the refuge that the large expanse of open water provides from terrestrial predators. However, use by some nesting waterbird species may be less if there is frequent motorboat use. In Maine, nesting waterbird richness was less in lacustrine wetlands than other wetland types, but the hosted species (loons, grebes) were less common in other wetland types so the lacustrine wetlands contributed disproportionately to regional bird diversity (Gibbs et al. 1991). *In calculations, presence increases the score but absence has no effect.*	Lacus13a
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.20	Most waterbirds require some unflooded shoreline for nesting, while also needing large areas of water and emergent vegetation for feeding.	SatPct13
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	4	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	5	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	2	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	1	1			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.50	Surface water that persists for all or most of a year (and especially, during the early summer) provides more physical habitat for waterbirds. If no surface water persists, waterbird nesting can still be substantial if the wetland borders a lake, large river, or estuary. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct13
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	1	0			
		1-20% of the AA.	1	2	2			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	4	0			
		>95% of the AA. True for many fringe wetlands.	0	3	0			
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				1.00	Most waterbirds situate their nests on or near persistent water. However, wetlands that flood only seasonally often provide more food and cover for young. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpct
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	4	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	5	5			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA.	0	1	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Large water level fluctuations during the nesting season (late spring and early summer), can flood the nests of birds that nest along wetland edges. However, annual fluctuations (described here) do not necessarily parallel propensity of water levels to fluctuate during the nesting season, and can stimulate wetland productivity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	Fluctu13
		<10 cm change (stable or nearly so).	0	0	0			
		10 cm - 50 cm change.	1	3	3			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	1	0			
		>2 m change.	0	0	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.43	Most waterbirds prefer depths of 1- 2 ft. Wetlands with greater depths will nonetheless usually have some portion of their area in this and shallower depth classes. Even the shallowest areas are important to many species. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth13
		<10 cm deep (but >0).	0	1	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	7	0			
		1 - 2 m deep.	0	5	0			
		>2 m deep. True for many fringe wetlands.	0	2	0			
F30	Depth Classes - Evenness of Proportions	When present, surface water in most of the AA usually consists of (select one):				0.00	Different waterbird species prefer different water depths, so a diversity of depth classes in a wetland is likely to support a more varied mix of waterbirds. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	DepthEven 13
		One depth class that comprises >90% of the AA's inundated area (use the classes in the question	1	0	0			
		One depth class that comprises 50-90% of the AA's inundated area.	0	1	0			
		Neither of above. There are 3 or more depth classes and none occupy >50%.	0	2	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.00	Most wetland birds tend to feed more in ponded areas than along channels. If these isolated pools areas persist well into the summer, they allow waterbird populations to establish more breeding territories within the site, as well as concentrating invertebrate foods. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	ISOdry13
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	0	0			
		5-30% of the water.	0	3	0			
		30-70% of the water.	0	4	0			
		70-95% of the water.	0	5	0			
		>95% of the water.	0	5	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F33	% of Ponded Water that is Open	In ducks-eye aerial view, the percentage of the ponded water that is open (lacking emergent vegetation during most of the growing season, and unhidden by a forest or shrub canopy) is:					Marshes with a relatively even mix of open water and emergent vegetation tend to support the most nesting waterbird species in this region (Gibbs et al. 1991, Longcore et al. 2006, Hierl et al. 2007). Emergent and submersed vegetation is an essential food for many duck species, either directly or because of the higher densities of invertebrate foods that it supports (Epners et al. 2010). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	AqPlantCov 13
		None, or <1% of the AA and largest pool occupies <0.01 hectares. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	1	0			
		1-4% of the ponded water. Enter "1" and SKIP to F41 (Floating Algae & Duckweed).	0	3	0			
		5-30% of the ponded water.	0	4	0			
		30-70% of the ponded water.	0	6	0			
		70-99% of the ponded water.	0	4	0			
		100% of the ponded water.	0	2	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Waterbird nests located in narrow wetlands may be more vulnerable to predation. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	VwidthAbs13
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F35	Flat Shoreline Extent	During most of the part of the growing season when water is present, the percentage of the AA's water edge length that is nearly flat (a slope less than about 5% measured within 5 m landward of the water)				1.00	A gentle shore slope provides waterbirds with easier access to upland nesting cover near the water (Staicer et al. 1994). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	ShoreSlope 13
		<1% of the water edge.	0	0	0			
		1-25% of the water edge.	0	1	0			
		25-50% of the water edge.	0	2	0			
		50-75% of the water edge.	0	3	0			
		>75% of the water edge.	1	4	4			
F36	Robust Emergents	The percentage of the emergent vegetation cover in the AA that is cattail (Typha spp.), common reed (Phragmites), or tall (>1m) bulrush is:				0.00	Tall robust vegetation provides better nesting cover than does shorter vegetation.	EmRobust13
		<1% of the emergent vegetation, or emergent vegetation is absent. SKIP to F38.	1	0	0			
		1-25% of the emergent vegetation.	0	2	0			
		25-75% of the emergent vegetation.	0	4	0			
		>75%, of the emergent vegetation.	0	3	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Interspersion of patches of open water amid patches of vegetation, in about equal proportions, provides waterbirds with the best access to aquatic foods (Longcore et al. 2006), and encourages establishment of breeding territories by more individual birds. Use of such wetlands has been shown to be significantly greater (Gibbs et al. 1991). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers13
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F40	Isolated Island	The AA contains (or is part of) an island or beaver lodge within a lake, pond, or river, and is isolated from the shore by water depths >1 m on all sides during an average June. The island may be solid, or it may be a floating vegetation mat that is sufficiently large and dense to support a waterbird nest.	0				Waterfowl nests on Islands that are inaccessible to mammalian predators are more successful (Loekmoen & Woodward 1992). *In calculations, is excluded automatically (cell goes blank) if wetland lacks an island, but if island is present, it counts as a positive.*	Island13
F47	pH Measurement	The pH in most of the AA's surface water:					When non-acidic ponds are available, most duck species prefer to nest in those rather than acidic lakes and wetlands (Paquette & Ankney 1996, Epners et al. 2010), and nestling survival of at least one species is less in low-pH wetlands (McAuley & Longcore 1988). Fish-eating waterbirds in this region are most productive when nesting in non-acidic ponds (pH of 5.5 or greater, Parker et al. 1992), but in Maine sometimes nested in lakes that were more acidic (Gibbs et al. 1991). Some nesting waterbird species in Maine seemed unaffected by pond pH (Parker et al. 1992). *In calculations, the indicator score is set to 0 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	Acidic13
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	At least in the short term, open water areas created by beaver dams provide excellent nesting and foraging habitat for several waterbird species (Gabor et al. 2002, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has ponded surface water during an average year.*	Beaver13
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F51	Internal Gradient	The gradient along most of the flow path within the AA is:				0.50	Most waterbirds favor ponded areas (that typically are flat) rather than flowing water that typifies slope wetlands.	Gradient13
		<2% or the AA has no surface water outlet (not even seasonally).	0	4	0			
		2-5%.	1	2	2			
		6-10%.	0	1	0			
		>10%.	0	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	In herbaceous wetlands, the type of adjoining upland cover is very important to many nesting waterbird species. Most upland-nesting waterfowl nest within about 1000 ft of wetlands. Maintaining mostly non-woody but natural vegetation in such areas makes it difficult for predators to find nests.	BuffNatPct13
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	The type as well as the amount of upland cover near the wetland is important to nesting waterbirds. Impervious surfaces are unusable, whereas some low-intensity rural lands can provide marginally suitable cover. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUtype13
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds. Even the simple presence of people on foot will cause many waterbirds to take flight (Burger 1981; Klein et al. 1995; Burger & Gochfeld 1998). Although some species may habituate to frequent disturbance more readily than others, repeated intrusions drain the energy of many waterbirds. This is especially damaging during cold weather, or when birds (especially shorebirds) are stopping briefly to feed during long migrations.	Core1_13
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2_13
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	2	2			
		5-50%.	0	1	0			
		50-95%.	0	0	0			
		>95% of the AA.	0	0	0			
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				Humans visiting wetlands commonly bring dogs, which potentially harass waterbirds, and human presence can attract crows and ravens, which prey on nests. Even the simple presence of people on foot and without dogs will cause many waterbirds to take flight. Repeated intrusions that drain the energy of waterbirds are especially damaging during the period when adult birds are searching for food to feed their young.	BMP13

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of waterbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq13
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of nesting waterbirds on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond13
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	1	1	1			
		50-500 m, but separated by those features.	0	1	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0			0.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to waterbird biodiversity at a regional scale.	Rare13
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	Wetland value is considered greater if it is part of an area recognised officially as being of outstanding importance to waterbirds. Such areas have been chosen through a systematic selection process by biologists and birders in this region and elsewhere.	_IBA13

HydroRegime	0.44	AVERAGE(ISOwet, SatPct, Fluctu, MAX(SeasWpct, PermWpct), Depth, DepthEven)	Hydro13
Structure		AVERAGE[(Interspers, AVERAGE(EmPct, EmRobust, SizeHerbac, Vwidth, AqPlantCov, Snags)]	Struc13
Productivity	0.54	AVERAGE(Wettype, Gradient, Acidity, ShoreSlope, Fish, Island)	Produc13
Waterscape	0.42	IF((Fen_ + Marsh=0), blank, ELSE: AVERAGE(Bduck, Lake, LakeProx, Fringe, Beaver, PondProx)]	Wscape
Stressors (lack of)	1.00	AVERAGE(Core1, Core2, BMP, Toxics)	Stressors13
Landscape	0.89	AVERAGE(BuffLUtype, BuffNatPct, RdDis)	Lscape13

Function Score for Nesting Waterbird Habitat	F	5.73	IF((AllSat=1), 0, IF((TooSteep=1),0, IF((TooSmall=1),0, ELSE: [3*AVERAGE(AqPlantCov, SizeHerbac, Wettype,Wscape) +2*AVERAGE(HydroRegime, Structure, Productivity) + AVERAGE(Stressors, Landscape)] / 6
Benefits Score for Nesting Waterbird Habitat	B	3.33	IF((Rare=1),1, IF((IBirdv=1),1, ELSE: MAX(DistPond, HerbUniq)

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Songbird, Raptor, & Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.	SBM

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.43	Larger wetlands generally support more bird species than smaller ones (Findlay & Houlahan 1997) as well as being used disproportionately by some species. Smaller identical wetlands of equal cumulative area might support equal or greater cumulative richness of songbirds and mammals, especially if they are close together and connected with corridors of undeveloped land. For predicting bird diversity, some evidence from peatlands (Calme and Desrochers 2000) suggests that wetland size may be less important than microhabitat heterogeneity (which is represented by other indicators).	SizeHerbac 14
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	2	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.78	Many songbirds and mammals occur only in larger tracts of natural land cover. Fragmentation of wooded riparian areas by residential development or clearcuts can, over the long term, reduce the diversity of songbirds nesting in the remaining patches (e.g., Smith & Wachob 2006). Breeding wetland birds sometimes do persist in small disturbed wetlands as long as much larger undisturbed wetlands nearby remain productive (e.g., Vermaat et al. 2008). Ideally, no clearing should result in a forest being fragmented into an isolate smaller than about 40 ha or narrower than 50 m, and definitely not smaller than about 1 ha or narrower than 30 m (Donnelly & Marzluff 2004). In the Seattle metro area, Pacific (Winter) Wren occurred mostly in areas with less than 20% surrounding urban cover and forest patch size of more than about 1 ha (Donnelly 2004, Donnelly & Marzluff 2006). Theoretical and limited empirical data suggest that 30% or more forest cover across a large area is the threshold value above which landscapes might provide sufficient habitat and connectivity for many forest species, allowing those species' populations to survive even in small remaining patches (Andren 1994). Minimum patch sizes required for breeding by the most sensitive forest songbirds (e.g., Brown Creeper) may be about 10 ha (Donnelly & Marzluff 2004, Poulin et al. 2008). However, a study in British Columbia old growth forest found patch size had little to do with the abundance or diversity of birds in the forest (Schieck et al. 1995).	NatVegSize 14
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	4	0			
		10 to 100 hectares.	0	6	0			
		100 to 1000 hectares.	1	7	7			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	9	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				1.00	Wetlands that are closer to natural land cover and not separated by roads that interfere with movements across the landscape, are more likely to support a large diversity of songbird and mammal species. Forest gaps deter red squirrel movement (Bakker & Van Vuren 2004) and hinder movements of many birds. Nests in wetland forest edges, where both jays and squirrels occur frequently, are depredated more often than those in wetland openings or forest interior, where predators were less common (Desanto & Wilson 2001). The probability that a forest-dwelling bird will fly in the open between two patches of forest decreases rapidly as the distance separating those patches increases (Desrochers & Hannon 1997, St. Clair et al. 1998). Forest bird species usually prefer to detour under forest cover even if the forested route is longer, but if the detour is too long, they will prefer a shortcut across openland. However, when possible most forest bird species avoid venturing farther than about 30 m from a forest edge (St. Clair et al. 1998)	NatVegProx 14
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	7	7			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	6	0			
		50-500 m, and not separated.	0	5	0			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 5 km, and not separated.	0	3	0			
		0.5 - 5 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.67	The total proportion of the land that is natural land cover, as well as its proximity, can affect songbird and mammal richness in wetlands. Wetlands that contain or are close to natural land cover, and not separated from that by roads that interfere with movements across the landscape, are more likely to support forest-dwelling species (Betts et al. 2007). In Ohio, migrant songbirds had the strongest positive correlation with natural land cover near streams when it was measured within ~250 m of streams, rather than in areas closer or farther. Some migrant songbirds were much less likely to occur where there were many buildings within that distance of streams (Pennington 2008). However, one study found that migrant bird abundance was statistically unrelated to either percent urbanised land or percent forest cover within 1 km.	NatVegPctScape14
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	0	2	0			
		60 to 90% of the land.	1	4	4			
		>90% of the land. SKIP to OF10.	0	6	0			
OF9	Type of Land Cover Alteration	Within the 5-km radius circle, and ignoring all permanent water, the land area that is bare or non-perennial cover is mostly:				1.00	The type as well as the amount of disturbed upland cover near the wetland is important to mammals and nesting songbirds. For most species, impervious surfaces are unusable. Habitat gaps caused by placement of roads, driveways, or homes – as well as by natural features such as wide tidal channels -- can impact movements of mammals and birds (Trombulak & Frissell 2000, Ortega & Capen 2002). This is especially true when the gaps are wider than about 30 m (Rich et al. 1994, Rail et al. 1997, St. Clair et al. 1998, Belisle & Desrochers 2002, Tremblay & St. Clair 2010), and definitely when wider than 60 m (Creegan & Osborne 2005, Bosschieter & Goedhart 2005, Awade & Metzger 2008, Lees & Peres 2009). Species that prefer low vegetation may be particularly reluctant to cross forest clearings. The presence of small clusters of trees scattered within very wide forest gaps may be sufficient to enhance willingness of some forest bird species to cross those gaps (Robertson & Radford 2009).	ScapeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare pervious surface, e.g., lawn, recent (<5 yrs ago) clearcut, dirt or gravel road, cropland, landslide, conifer plantation.	1	1	1			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.63	High nest predation occurs on the edges of residential areas because jays and ravens are more abundant there. Nest predation can also be high in clearcut openings. Human settlements are accompanied by an increase in refuse, whether it be illegally dumped trash, recklessly contained household garbage, or well-intended compost piles. These serve as a food for ravens that prey extensively on native songbirds, frogs, and other wildlife (Chace & Walsh 2006). Crow populations have been shown to increase up to at least 1 km from new urban areas (Oneal & Rotenberry 2009).	PopCtr14
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	0	3	0			
		1 - 5 km.	1	5	5			
		>5 km.	0	8	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Traffic poses a hazard to songbirds and mammals that attempt to cross roads (Forman et al. 2002, Clevenger et al. 2003, Massey et al. 2008, Minor & Urban 2010, Tremblay & St. Clair 2010, and see reviews by Fahrig & Rytwinski 2009, Benitez-Lopez et al. 2010). Roadsides also may channel the movements of predators. Noise from heavy traffic interferes with bird reproduction because some birds cannot hear singing of prospective mates (Wood & Yezerinac 2006, Slabbekoom & Ripmeester 2008, Barber et al. 2010) and road noise can restrict habitat use by bats (Schaub et al. 2008) and moose (Snaith et al. 2002).	DisRd14
		<10 m.	0	0	0			
		10 - 25 m.	0	2	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	0	6	0			
		>500 m.	1	8	8			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			0.00	Roads that completely encircle a wetland limit the access to the wetland by upland mammals, and may isolate small mammal populations within the wetlands. To sustain most forest-dwelling bird species, linear clearings should cause no gap in the forest canopy wider than about 30 m (Belisle & Desrochers 2002, Tremblay & St. Clair 2010). Roads also tend to concentrate nest predators.	RdBox14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.71	Many wetland songbirds and mammals may prefer landscapes where multiple wetlands are present in close proximity, so that if birds are disturbed in one area, they can use alternate sites which may provide different but complementary types of food and cover. Corridors can be important to small mammals moving between wetlands.	PondProx14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	7	0			
		<50 m, but completely separated by those features.	0	6	0			
		50-500 m, and not separated.	1	5	5			
		50-500 m, but separated by those features.	0	4	0			
		0.5 - 1 km, and not separated.	0	3	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF16	Upland Edge Contact	Select one:				1.00	When wetland perimeter mostly adjoins upland rather than more wetland, this allows animals to move more conveniently between uplands and wetlands, benefitting from resources in each. In particular, small mammals avoid wetter (usually more central) parts of wetlands in favor of drier edges (Mazerolle et al. 2001).	UpEdge14
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF32	Wintering Deer or Moose Concentration Areas	If AA is on private land with no information, change to blank (not 0). Otherwise: With the Provincial Landscape Viewer, for Wintering Moose, go to Wildlife> Significant Habitat. For Mainland Moose Concentration Areas, go to Wildlife> Special Management Practice Zones. Enter: yes= 1, no= 0.	1			1.00	Although hardly representative of the needs of all wetland-dependent songbirds and mammals, the presence of suitable wintering habitat for deer is an important component of this function. However, very high deer densities reduce habitat for ground- and understory-nesting birds.	DeerHab14
F2	Wetland Types - Adjoining or Subordinate	If the AA is smaller than 1 ha, mark all other types that occupy more than 1% of the vegetated AA. If the AA is larger than 1 ha, mark all other types which are within or adjacent to the AA and occupy more than 1 ha, as visible from the AA or as interpreted from aerial imagery. Do not mark again the type marked in F1.				0.00	Because different wetland types are likely to support different species and/or many of those species may use complementary wetland types nearby for part of their life cycle, the presence of contrasting wetland types is likely to help support a diverse assemblage of songbird and raptor species in any one of the wetlands. *In calculations, the indicator score is the sum of the nearby types divided by 3.*	WetTypeDiv14
		A1.	0					
		A2.	0					
		B1.	0					
		B2.	0					
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0			0.00	Songbird richness within a site is strongly associated with a diversity of height classes, combined with a mix of conifer and deciduous trees/shrubs in each height class. Trees and shrubs support a wider diversity of songbirds, raptors, and mammals than does herbaceous vegetation, partly because they provide more vertical structure and produce downed wood and snags that have other habitat benefits. Trees help shelter the water in wetlands from high winds, facilitating the aerial foraging activities of birds and bats (Whitaker et al. 2000). *In calculations, the indicator score is based on number of height-form classes (of a possible 6).*	WoodyHtDiv14
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover. Then choose one:					Lack of one dominant shrub species suggests higher shrub richness, which has the potential to provide more food sources to more species throughout a season. *In calculations, is excluded automatically (cell goes blank) if wetland has <5% shrub cover. If second choice is marked this indicator is scored as a 1 but if first choice is marked this indicator is ignored in model calculations.*	ShrubDiv14
		those species together comprise > 50% of such cover.	0	1	0			
		those species together do not comprise > 50% of such cover.	0	2	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					Tree cavities needed by many nesting songbirds and mammals are found mostly in dead standing trees (snags) and larger-diameter trees. Larger-diameter stands also tend to be older and provide more structure useful to a variety of songbirds and mammals. Taller snags are especially useful to raptors as hunting perches. A mixture of tree species, especially mixtures that include aspen, is necessary to sustain populations of most boreal woodpecker species (Drever & Martin 2010). Deer need a diversity of forest types and ages (both early succession and old growth) near each other within their home ranges (Chang et al. 1995), as do moose (Snaith et al. 2002). *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The indicator score is based equally on the proportion of classes present and their weighted average.*	TreeTypes14
		coniferous, 1-9 cm diameter and >1 m tall.	0	1	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	3	0			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	4	0			
		coniferous, 20-40 cm diameter.	0	3	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Interspersion of woody cover with food-rich openings of herbaceous vegetation provides greater feeding opportunities for many songbirds and mammals, and is a natural phenomenon caused by windthrow and other factors in forested wetlands. In British Columbia, activity levels of bats were more than 40 times greater in riparian than in upland areas, due to greater abundance of emerging aquatic insects, and were significantly greater where stand complexity and extent of forest edges was greater. Gaps of 3-10 trees in an otherwise forested matrix, that comprise about 30% of the matrix, resemble most closely the conditions in mature forest of Vancouver island, BC (Lertzman et al. 1964). Most canopy gaps occupy 50-200 m2 and a diameter-height ratio is typically <0.50 (Ott & Juday 2002). Excessive gap frequencies and areas (i.e., forest fragmentation) and lack of corridors that connect forested wetlands with upland forests can be detrimental to some species if the remaining forested patches are very small. *In calculations, is excluded automatically (cell goes blank) if wetland has little or no woody cover.*	WoodPatt14
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or bands, clumps, or is completely absent.	0	0	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:					Tree cavities are needed by many nesting songbirds (Drapeau et al. 2009) and mammals such as roosting bats (Grindal & Brigham 1999, Grindal et al. 1999). Tall snags are especially useful to raptors as hunting perches. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	SnagsD14
		None, or fewer than 8/ hectare which exceed this diameter.	0	1	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	2	0			
		Several (>8/hectare) but above not true.	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Standardise	Rationales	Cell Name
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides cover for many small mammals. Downed wood is often the result of natural windthrow, which also creates small patches of semi-open canopy within blocks of forest and in so doing can support a larger number of wildlife species, despite the temporary loss of nest trees (Zmihorski 2010). In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. *In calculations, is excluded automatically (cell goes blank) if few or no trees of any kind are present. If downed wood is numerous it is scored as a 1 but if absent this indicator is ignored in model calculations.*	WoodDown 14
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.25	Due to fertilizing effects of its nitrogen-fixing capacity, alder can increase the abundance of forbs important to songbirds and other wildlife.	Nfix 14
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	1	1			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Although scattered open spots provide feeding opportunities for some species, most ground-nesting songbirds and mammals prefer dense ground cover as concealment from predators. Thinning of ground cover by high densities of deer can impact songbirds (Thiemann et al. 2009, Martin et al. 2010).	Gcover14
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	5	5			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	4	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Complex microtopography reflects and provides more extensive habitat for small mammals and some songbirds.	Girreg14
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F13	Upland Inclusions	Within the AA, inclusions of upland are:					Wetlands with upland inclusions allow animals to move more conveniently between uplands and wetlands, using resources in each.	Inclus14
		Few or none.	1	0	0			
		Intermediate (1 - 10% of vegetated part of the AA).	0	1	0			
		Many (e.g., wetland-upland "mosaic", >10% of the vegetated AA).	0	2	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				1.00	Most songbirds prefer to nest in drier parts of wetlands because ground cover and vegetation height, which provide essential structure, tend to be greater there.	SatPct14
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	4	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	6	6			
		99-100% . AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				1.00	Parts of wetlands that remain flooded most of the time will support fewer small mammals and songbirds due to lack of vertical structural complexity. Wetlands with at least a little persistent water are important to aerially-foraging swallows, swifts, and flycatchers, as well as bats, muskrat, beaver, moose, and many other mammals. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	PermWpct14
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	3	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wider vegetated zones within wetlands provide more nesting space and structure for songbirds and mammals. Wider riparian buffers in British Columbia supported a greater density of deciduous trees important to wildlife diversity in that region (Shirley 2004). Also in British Columbia, even buffers of 150 m failed to support several species at densities equivalent to those in extensive uncut forests: Brown Creeper, Pileated Woodpecker, Golden-crowned Kinglet. However, at least 2 species -- Warbling Vireo and Swainson's Thrush – were more common in buffers than in uncut forest (Shirley & Smith 2005). The diversity of microhabitats within bogs and fens generally increases with increasing area, and vertebrate richness consequently increases (Desrochers & van Duinen 2006). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	Vwidth14
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					When water and vegetation (especially woody or other robust vegetation) are moderately interspersed, this provides more extensive feeding areas for many wetland-dependent songbirds and raptors. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	Interspers14
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver impoundments, especially after they are abandoned and revert to early successional shrubs, support higher bird species richness than many other land cover types (Grover & Baldassarre 1995, Aznar & Desrochers 2008) and are also important to river otter (LeBlanc et al. 2007, Gallant et al. 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Beaver14
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.80	To help maintain biodiversity in central and eastern New Brunswick, vegetated buffers of >30 m width should mostly surround wetlands (Betts & Forbes 2005). However, riparian buffer strips 50 m wide were insufficient to maintain nesting forest interior songbird species in Newfoundland (Whitaker & Montevecchi 1999).	BuffPerim14
		<5%.	0	0	0			
		5 to 30%.	0	1	0			
		30 to 60%.	0	2	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	5	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Small mammals moving between wetlands are less likely to have their movements disrupted by lands with residual cover than in lands with impervious surface, but both are capable of hindering dispersal (Flaherty et al. 2008). *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	CUtypeLU14
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Some of these features are important to bank-living beavers, swallows, and swifts. *If present this indicator is scored as a 1 but if absent this indicator is ignored in model calculations.*	Cliffs14
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Human presence can attract crows and ravens which prey on nests. Dogs and house cats that prey on wetland songbirds and mammals also tend to be more prevalent in areas frequently visited by humans.	Core14a
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core14b
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	3	3			
		5-50%.	0	2	0			
		50-95%.	0	1	0			
		>95% of the AA.	0	0	0			
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of songbirds on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq14
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	0			0.00	Dependency of songbirds on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq 14
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.25	Dependency of wetland-associated songbirds, raptors, and mammals on a particular wetland (and thus its importance) increases if no other wetlands or ponds are available in the vicinity.	DistPond14
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	0	0			
		50-500 m, and not separated.	1	1	1			
		50-500 m, but separated by those features.	0	1	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	2	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	4	0			
OF29	Species of Conservation Concern	Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1			1.00	Such wetlands may be considered more valuable because the rare species they host contribute disproportionately to songbird biodiversity at a regional scale. In New Brunswick, wetlands are used to a greater extent than other habitats by the bird species identified as being of highest conservation concern (Environment Canada 2013).	Rare14
OF30	Important Bird Area (IBA)	In Google Earth, open the KMZ file that accompanies this calculator, called IBAs_Canada. The AA is all or part of an officially designated IBA. Enter 1= yes, 0= no.	0			0.00	These areas were designated based on a rigorous nomination and screening process by ornithologists.	_IBA14

StructureA	0.83	AVERAGE (Gcover, Girreg, Cliffs, SnagsD, WoodDown, DeerHab)	StrucA
StructureB		AVERAGE (WoodyHtDiv, ShrubDiv, WoodPatt, TreeTypes)	StrucB
Productivity	0.29	(AVERAGE(SizeHerbac, Vwidth))*((AVERAGE(Nfix, Inclus, UpEdge, Hardwd)))	Produc
Landscape	0.75	AVERAGE (WetTypeDiv, CUbuffNatPct, CUtypeLU, NatVegProx, NatVegPctScape, ScapeLU, NatVegSize)	Lscape14
Waterscape	0.93	AVERAGE (SatPct, PermWpct, PondProx, Beaver, Interspers)	Wscape14
Stressors (Lack of)	0.73	AVERAGE (CoreA, CoreB, BuffPerim, PopCtr, RdBox, DisRd)	Stress14

Function Score for Songbird, Raptor, & Mammal Habitat	F	8.53	IF((AllWater=1),0, ELSE: (AVERAGE(PermWpct, AVERAGE(StrucA, StrucB, Produc, Lscape, Wscape, Stress))
Benefits Score for Songbird, Raptor, & Mammal Habitat	B	10.00	IF((Rare=1),1, IF((IBA=1),1, ELSE: MAX(HerbUniq, WoodyUniq, DistPond)

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Pollinator Habitat		The capacity to support a diversity or abundance of pollinating insects, such as bees, wasps, flies, butterflies, moths, and beetles.	POL					
#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				1.00	Native pollinators are most abundant and diverse where naturally vegetated areas are nearby. Distance to such areas is often a strong predictor (Westphal et al. 2006, Ricketts et al. 2008, Garibaldi et al. 2011). However, the minimum size of such patches that is capable of influencing pollinators is unknown.	DistNat0
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	6	6			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.75	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded by a large proportion of unmanaged vegetation (Savage et al. 2011, Kennedy et al. 2013, Moisan-Deserres et al. 2014b, Cutler et al. 2015).	CovPct Scape0
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	0	2	0			
		60 to 90% of the land.	1	3	3			
		>90% of the land. SKIP to OF10.	0	4	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				1.00	Among woody plants, low shrubs such as blueberry and current tend to be the most common sources of pollen for pollinating insects, and are most dependent on insects for pollination. *In calculations, the woody plant height and form that is most favoured by pollinators (column E) and is most predominant (column D) is identified automatically and placed on the 0 to 1 scale.*	WoodyHt Form0
		coniferous trees (may include tamarack) taller than 3 m.	1	0	0	5		
		deciduous trees taller than 3 m.	1	1	1			
		coniferous or ericaceous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1	3	3			
		deciduous shrubs or trees 1-3 m tall not directly below the canopy of trees.	1	4	4			
		coniferous or ericaceous shrubs <1 m tall not directly below the canopy of taller vegetation.	1	5	5			
		deciduous shrubs or trees <1 m tall (e.g., deciduous seedlings) not directly below the canopy of taller vegetation.	1	5	5			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					A wider variety of woody plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	ShrubDiv0
		those species together comprise > 50% of such cover.	0	1	0			
		those species together do not comprise > 50% of such cover.	0	0	0			
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					A mix of diameter classes may indicate a wider variety of woody species available for pollination. The formula gives equal weight to the variety of classes and increasing mean diameter. Deciduous trees allow more light penetration and thus tend to support more flowering plants in the understory. Larger trees provide more deadwood for bee and wasp colonies. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees. The score is based equally on the proportion of classes present and their weighted average.*	woodydbh0
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	1	0			
		coniferous, 10-19 cm diameter.	0	2	0			
		broad-leaved deciduous 10-19 cm diameter.	0	3	0			
		coniferous, 20-40 cm diameter.	0	4	0			
		broad-leaved deciduous 20-40 cm diameter.	0	6	0			
		coniferous, >40 cm diameter.	0	5	0			
		broad-leaved deciduous >40 cm diameter.	0	8	0			
F7	Large Snags (Dead Standing Trees)	The number of large snags (diameter >20 cm) in the AA plus adjacent upland area within 10 m of the wetland edge is:					Dead wood provides critical nesting habitat for many pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	Sngs0
		None, or fewer than 8/ hectare which exceed this diameter.	0	0	0			
		Several (>8/hectare) and a pond, lake, or slow-flowing water wider than 10 m is within 1 km.	0	1	0			
		Several (>8/hectare) but above not true.	0	1	0			
F8	Downed Wood	The number of downed wood pieces longer than 2 m and with diameter >10 cm, and not persistently submerged, is:					Downed wood provides nest sites and shelter for some pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland has few or no trees.*	downwood0
		Few or none that meet these criteria.	0	0	0			
		Several (>5 if AA is >5 hectares, less for smaller AAs) meet these criteria.	0	1	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.33	A small proportion of bare earth is important to some burrowing pollinators, but too much is at the expense of plants that provide pollen (Moisan-Deserres et al. 2014a).	gcover0
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	1	1			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	3	0			
		Other conditions.	0	0	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Many pollinating species depend on such microtopographic features for nest sites and cover.	girreg0
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F17	Forb Cover	Within parts of the AA having herbaceous cover (excluding SAV), the areal cover of forbs reaches an annual maximum of:				0.25	Flowers from forbs provide the most opportunities for a diverse array of pollinator species, but some graminoids (e.g., native bunchgrasses) are used as well.	Forbs0
		<5% of the herbaceous part of the AA.	0	0	0			
		5-25% of the herbaceous part of the AA.	1	1	1			
		25-50% of the herbaceous part of the AA.	0	2	0			
		50-95% of the herbaceous part of the AA.	0	3	0			
		>95% of the herbaceous part of the AA.	0	4	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	A wider variety of herbaceous plant species suggests greater availability of pollen and nectar throughout the year, and this helps sustain diverse pollinator populations.	herbdiv0
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Although some non-native plants attract pollinators, many of those plants tend to be invasive, reducing the overall diversity of plant species available for pollination at different times of the season (Thijs et al. 2012). A broad seasonal distribution of available pollen and nectar sources is critical to maintaining pollinator diversity.	herbsens0
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F25	% of AA with Persistent Surface Water	Identify the parts of the AA that still contain surface water (flowing or ponded, open or hidden beneath vegetation) even during the driest times of a normal year, i.e., when the AA's surface water is at its lowest annual level. At that time, the percentage of the AA that still contains surface water is:				0.80	Wetlands comprised almost entirely of persistent water usually have much less vegetation cover, so fewer plants per unit area are available to pollinators. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	persist0
		None. The AA dries up completely (no water in channels either) or never has surface water during most years. SKIP to F27.	0	5	0			
		1-20% of the AA.	1	4	4			
		20-50% of the AA.	0	3	0			
		50-95% of the AA.	0	2	0			
		>95% of the AA. True for many fringe wetlands.	0	1	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				1.00	The widest variety and/or greatest abundance of pollinators is likeliest to occur in areas surrounded at least partially by, or close to, unmanaged vegetation (Moisan-Deserres et al. 2014b, Cutler et al. 2015).	BuffPerim0
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	3	3			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	3	0			
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.00	See above. *In calculations, is ignored if >90% of the wetland perimeter has a vegetated buffer. In other situations, the indicator score is set to 0 if impervious but otherwise is ignored in the model calculations.*	BuffLUtype0
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F55	Cliffs or Steep Banks	In the AA or within 100 m, there are elevated terrestrial features such as cliffs, talus slopes, stream banks, or excavated pits (but not riprap) that extend at least 2 m nearly vertically, are unvegetated, and potentially contain crevices or other substrate suitable for nesting or den areas. Enter 1 (yes) or 0 (no).	0	1	0		Rocky and other bare areas are more likely to support burrows for pollinator nests and mud for hive construction (Moisan-Deserres et al. 2014a).	cliff0
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.44			0.56	Many pollinators are highly sensitive to some of the pesticides used in this region (e.g., Kevan 1975, Plowright & Rodd 1980, Brittain et al. 2010, Gradish et al. 2012).	Toxic0

#	Benefit Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of pollinators on a particular herbaceous wetland (and thus its importance) increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq0
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	0			0.00	Dependency of pollinators on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq0
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0			0.00	Pollinators may be especially valuable if the wetland contains a rare plant species dependent on insect pollination (Jones & Klemetti 2012).	RareHerb

Pollen Onsite	0.89	AVERAGE[MAX(WoodyHtForm, Forbs), AVERAGE(herbsens, herbdiv, ShrubDiv)]	PollenOn
NestSites	0.61	AVERAGE[persist, AVERAGE(woodydbh, snags, downwood, girreg, cliff, gcover)]	NestSites
Stressors (lack of)	0.66	AVERAGE(Toxic, CovPctScape, DistNat, BuffPerim, BuffLUtype)	Stress0

Function Score for Pollinator Habitat	F	7.19	IF(AllWet=1), 0, AVERAGE(PollenOnsite, NestSites, Stress)
Benefits Score for Pollinator Habitat	B	3.33	MAX(HerbUniq, WoodyUniq, RareHerb)

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Native Plant Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups.	PH						
#	**Function Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationales**	**Cell Name**
OF2	Ponded Area Within 1 km.	The area of surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.29	Larger wetlands generally support more plant species than smaller ones (Weiher & Boylen 1994, Findlay & Houlahan 1997, Matthews 2004, Houlahan et al. 2006) although in some landscapes, smaller identical wetlands of equal cumulative area support equal or greater cumulative richness of plants (Peintinger et al. 2003).	SizePD
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	1	2	2			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	5	0			
		>100 hectares.	0	7	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.75	Although urbanization typically reduces the diversity of plants in the forest understory, plant community composition in a Wisconsin study was better explained by the amount of surrounding forest than by environmental factors within the studied forests (Rogers et al. 2009). A leveling off of the plant species-area accumulation curve in Alberta forests appeared at a forest patch size of about 10 ha (Gignac & Dale 2007). A study in Washington found that forest patches as small as 1 ha, if not narrow, may be large enough to have a microclimate supportive of most plants and animals (Heithecker & Halperin 2007). Depending on their shape, forest patches sised about 4 ha or larger may provide habitat capable of sustaining a diverse array of bryophyte functional groups in temperate rainforest landscapes (Baldwin & Bradfield 2007).	SizeVeg Connec15
		<0.01 hectare (about 10 m x 10 m).	0	0	0			
		0.01 - 0.1 hectare.	0	1	0			
		0.1 - 1 hectare.	0	2	0			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	5	0			
		100 to 1000 hectares.	1	6	6			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	8	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				1.00	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006).	DistBig15
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	6	6			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	5	0			
		50-500 m, and not separated.	0	4	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	2	0			
		0.5 - 5 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	0	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.75	In Ontario, forested wetlands with the most plant species were those with the largest areas and the largest proportion of upland forest within 250 m of the wetlands (Houlahan et al. 2006). However, one study found that forested wetlands in developed landscapes had community composition and structure similar to those in undeveloped landscapes, with number of exotic species being no greater (Ehrenfeld 2005)	VegPct5k15
		<5% of the land.	0	0	0			
		5 to 20% of the land.	0	1	0			
		20 to 60% of the land.	0	2	0			
		60 to 90% of the land.	1	3	3			
		>90% of the land. SKIP to OF10.	0	4	0			
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.67	Non-native plants that can reduce native plant richness tend to be more prevalent closer to population centers because many have been introduced intentionally or unintentionally by humans.	PopCtr15
		<100 m.	0	0	0			
		100 - 500 m.	0	2	0			
		0.5- 1 km.	0	3	0			
		1 - 5 km.	1	4	4			
		>5 km.	0	6	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				1.00	Road corridors are a significant vector for non-native plants that can reduce native plant richness if they invade nearby wetlands.	DistRdPD
		<10 m.	0	0	0			
		10 - 25 m.	0	4	0			
		25 - 50 m.	0	5	0			
		50 - 100 m.	0	5	0			
		100 - 500 m.	0	5	0			
		>500 m.	1	6	6			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.67	Wetlands that are more geographically isolated from each other may be likely to have lower plant species richness than those close together (Nekola 1999).	PondProx15
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	6	0			
		<50 m, but completely separated by those features.	0	5	0			
		50-500 m, and not separated.	1	4	4			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	2	0			
		0.5 - 1 km, but separated by those features.	0	1	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	0	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.13	Wetlands, especially bogs, that are ice-free for longer during the year, as inferred from growing degree days, tend to have more plant species (Glaser 1992).	GDDpd
OF37	Calcareous Region	The AA is NOT in a subregion that has been heavily exposed to acid precipitation. Enter "1" if true (green or yellow in map in Appendix A of the Manual). Enter "0" if false. If no information, change to blank.	0			1.00	Many species which contribute disproportionately to regional biodiversity due to their rarity occur in areas of limestone (calcareous) bedrock and soils, and not where exposure to acid precipitation is great. This indicator is ignored in calculations unless calcareous soils or bedrock are present or site is in a region where exposure to acid precipitation is relatively limited.	Karst16a
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.	0			0.00	Plant species richness within a site may be broadly associated with a diversity of height classes, especially if combined with a mix of conifer and deciduous trees/shrubs in each height class (Brandt et al. 2015). *Score is based on number of height-form classes (of a possible 6) that are present.*	WoodyHtDiv 15

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F3A	Deciduous Woody Cover		1			0.17	Deciduous cover allows more light to penetrate to the ground than does evergreen cover. In many instances this results in greater richness of understory plant species. *In calculations, is excluded automatically (cell goes blank) if few or no trees are present. Score is based on maximum deciduous cover in either the shrub (1-3 m) or tree (>3 m) categories.*	DecidCov15
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					A dominance of common species usually implies overall reduction in plant species richness. Although shrubs contribute to onsite plant diversity, wetland shrub communities are generally less diverse than herbaceous plant communities in wetlands. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodSp Dom15
		those species together comprise > 50% of such cover.	0	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					Wetland plant species richness often correlates positively with presence of a relatively even and dispersed mix of herbaceous and woody vegetation within the wetland (Brandt et al. 2015). Sparse woody cover sometimes indicates overgrazing by deer, which reduces plant diversity (Thiemann et al. 2009, Martin et al. 2010). *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	WoodHerb Mix15
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.67	Red alder often occurs in mildly disturbed settings, and through its ability to increase soil fertility by fixing nitrogen, can increase the cover and perhaps the diversity of understory plants. However, as alder stands age, they form a closed canopy which can block light and reduce understory plant richness.	NfixPD
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	2	2			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	2	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	1	0			
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Different plant species occur under different moisture regimes, which correlate with different elevations (Samoni et al. 2010), so a greater diversity of elevations (i.e., complex microtopography) often supports a wider variety of plants. Adding small ridges and furrows to constructed depressional wetlands was found in one study to increase their percent cover of obligate wetland species (Alsfeld et al. 2009). Wetlands with more varied topography tended to have greater plant species richness because this creates different flood frequencies within the wetland (Pollack et al. 1998).	GirregPD
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				1.00	Coarse soils tend to be less productive and in some cases this results in reduced species richness of wetland plants. Wetland soils with higher organic content often support greater plant species richness (e.g., Alsfeld et al. 2009).	SoilTexPD
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	2	0			
		Shallow Peat or organic <40 cm deep.	1	2	2			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Wetlands not dominated by one or two plant species are generally more diverse (e.g., Houlahan & Findlay 2004). *In calculations, is excluded automatically (cell goes blank) if little or no exposed herbaceous cover is present.*	herbdom15
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Invasion by non-native species often reduces native plant species richness (Zedler & Kercher 2004, Schooler et al. 2006) but not always (Houlahan & Findlay 2004). In some regions, a change of only 10 cm in mean water level or a change of only 2 cm in the degree of fluctuation may cause a shift from native to non-native species (Magee & Kentula 2005).	Invas15
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			InvasDom1
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				1.00	Although not all invasive upland plants are capable of establishing sustained populations in wetlands, many can. When they do they reduce plant diversity.	WeedSourc ePD
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	4	4			
		some (but <5%) of the upland edge.	0	3	0			
		5-50% of the upland edge.	0	2	0			
		most (>50%) of the upland edge.	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.75	More plant species occur in drier parts of wetlands than in parts that remain flooded for long duration. However, long duration flooding adds some aquatic species not otherwise found in wetlands.	SatPct15
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	1	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	2	0			
		25-50% of the AA never contains surface water.	0	3	0			
		50-75% of the AA never contains surface water.	0	4	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	3	3			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	2	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F27	% of AA that is Flooded Only Seasonally	The percentage of the AA's area that is between the annual high water and the annual low water (surface water) is:				0.25	In many regions, wetlands with extensive seasonal flooding tend to have greater plant species richness (Pollack et al. 1998). Seasonal inundation brings in external nutrients to riverine wetlands, and in all wetlands is necessary for seed germination of many wetland plant species. For determining the number of plants and number of species that germinate, the monthly timing of first soil moistening may be more important than the duration of the pre-inundation moist period or the length of inundation (Bliss & Zedler 1997). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	SeasWpctPD
		None, or <0.01 hectare and <1% of the AA. SKIP to F29.	0	0	0			
		1-20% of the AA, or <1% but >0.01 ha.	1	1	1			
		20-50% of the AA.	0	2	0			
		50-95% of the AA.	0	3	0			
		>95% of the AA.	0	4	0			
F28	Annual Water Fluctuation Range	The annual fluctuation in surface water level within most of the parts of the AA that contain surface water at least temporarily is:				1.00	Wetlands with naturally fluctuating water levels tend to have greater plant species richness, at least in Southeast Alaska floodplains (Pollack et al. 1998). Duration, frequency, and timing of inundation may be more important than magnitude of fluctuation, but cannot be estimated during a single visit to an ungaged wetland. Prolonged deep flooding can reduce plant species richness (Bayley & Guimond 2009). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or if none of it floods only seasonally.*	FlucPD
		<10 cm change (stable or nearly so).	0	1	0			
		10 cm - 50 cm change.	1	2	2			
		0.5 - 1 m change.	0	2	0			
		1-2 m change.	0	2	0			
		>2 m change.	0	1	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.67	With regard to submersed aquatic plants, shallower areas generally have greater plant richness due to greater availability of light and sediment oxygen. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	Depth15
		<10 cm deep (but >0).	0	6	0			
		10 - 50 cm deep.	1	4	4			
		0.5 - 1 m deep.	0	3	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.50	Wetlands with wider vegetated areas are more likely to contain more plant species and rarer and more sensitive plants, as well as being more insulated from some upland disturbances (Rooney & Bayley 2011). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.*	WidthPD
		<1 m.	0	0	0			
		1 - 9 m.	0	1	0			
		10 - 29 m.	0	2	0			
		30 - 49 m.	1	3	3			
		50 - 100 m.	0	4	0			
		> 100 m, or open water is absent at that time.	0	6	0			
F37	Interspersion of Emergents & Open Water	During most of the part of the growing season when water is present, the spatial pattern of emergent vegetation within the water is mostly:					Relatively even mixes of emergent plants and open water imply that both submerged aquatics and emergents may be present, thus comprising greater diversity. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, if no ponded water, if ponded water but no vegetation, if ponded but no open water.*	IntersperPD
		Scattered. More than 30% of such vegetation forms small islands or corridors surrounded by water.	0	3	0			
		Intermediate.	0	2	0			
		Clumped. More than 70% of such vegetation is in bands along the wetland perimeter or is clumped at one or a few sides of the surface water area.	0	1	0			
F44	Tributary Channel	At least once annually, surface water from a tributary channel that is >100 m long moves into the AA. Or, surface water from a larger permanent water body adjacent to the AA spills into the AA. If it enters only via a pipe, that pipe must be fed by a mapped stream or lake further upslope. If no, SKIP to F47 (pH Measurement).	1			1.00	Inflowing streams bring plant propagules that can sprout and diversify wetland plant communities. Wetlands with surface water connections also tend to be more fertile, although suspended silt can reduce submerged aquatic plants.	InflowPD
F47	pH Measurement	The pH in most of the AA's surface water:					Acidity (pH) influences the species composition, diversity, and productivity of plants within this region's wetlands (Catling et al. 1986, Mullen et al. 2000). Although acidic wetlands tend to be less fertile, they often are the most diverse (e.g., Woodcock et al. 2005). Especially when located near the coast, they often contain plant species that are regionally rare because they cannot withstand the competition present in less acidic, more fertile wetlands that occur more widely (Moore et al. 1989). However, acidic lakes that are naturally stained by tannins ("brownwater lakes") have fewer submersed aquatic plant species because the stained water reduces underwater light (Kerekes & Freedman 1989). *If pH is <5.5, the indicator score is set to 1. Otherwise, this indicator is ignored in calculations.*	Acidic20
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):					Nutrients, as represented indirectly by conductivity and/or TDS, directly influence the species composition (Srivastava et al. 1995), diversity, and productivity of plants within this region's wetlands, perhaps to a greater degree than acidity. In nearby regions, plant species richness in wetland quadrats declined with increasing nitrate and phosphorus (Houlahan et al. 2006), especially when conductivity exceeded ~400 μS/cm (Johnson & Leopold 1994). *In calculations, the score is set to 1 if TDS exceeds 220 mg/L or conductivity exceeds 400 uS/cm). In calculations, indicator is ignored if any other condition exists.*	Conduc20
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in μS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Beaver impoundments increase richness of wetland plants locally, especially a few years after they are abandoned (Pollock et al. 1998, Wright et al. 2002, 2003; Gallant et al. 2004, Bayley & Guimond 2008, Hood & Bayley 2008). *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	BeaverPD
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface water.	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F50	Groundwater Strength of Evidence	Select first applicable choice:				0.00	Partly because of the greater nutrient levels and relative hydrologic stability of most groundwater (Langlois et al. 2015), several plant species thrive best where a wetland's surface water originates most directly from groundwater (e.g., Radies et al. 2009). *In calculations, is excluded automatically (cell goes blank) if no evidence of groundwater influx; otherwise is rated based on response in column D.*	GWpd
		Springs are known to be present within the AA, or if groundwater levels have been monitored, that has demonstrated that groundwater primarily discharges to the wetland for longer periods during the year than periods when the wetland recharges the groundwater.	0	2	0			
		Most of the AA has a slope of >5%, or is very close to the base of a natural slope longer than 100 and much steeper than the slope of the AA, AND the pH of surface water, if known, is >5.5.	0	1	0			
		Neither of above is true, although some groundwater may discharge to or flow through the AA. Or groundwater influx is unknown.	1	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage of that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	Lichens and mosses have been affected by edge-induced microclimate changes extending at least 50 ft into forested areas (Hylander et al. 2002, Boudreault et al. 2008) and as far as ~150 ft from the forest edge (Baldwin & Bradfield 2005). In Oregon, selective thinning of forests that adjoined riparian buffers did not affect the herbaceous or shrub cover in the buffers when they were wider than ~50 ft (Anderson & Meleason 2009). Thinning can increase the distance seeds disperse into the forest and the number that disperse successfully (Cadenasso et al. 2001). One study found that where more than 50% of the basal area was cut, a significantly different plant community structure resulted. Partial cutting did not significantly change abundance for most of the important forage species for deer.	NatVegCApd
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			

#	Function Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				1.00	Some types of surrounding land cover are more likely to produce propagules of invasive plants that may reduce native plant richness in an adjoining wetland. *In calculations, is excluded automatically (cell goes blank) if F52 was answered ">90%".*	BuffLUpd
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	0	0			
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1			
F57	Burn History	More than 1% of the AA's previously vegetated area:					At least in herbaceous wetlands, infrequent moderate-intensity fires diversify the herbaceous plant community, partly by releasing nutrients bound in soils and vegetation, and reducing shade and competition (e.g., de Szalay & Resh 1997).	Burn20
		Burned within past 5 years.	0	4	0			
		Burned 6-10 years ago.	0	3	0			
		Burned 11-30 years ago.	0	2	0			
		Burned >30 years ago, or no evidence of a burn and no data.	1	1	1			
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				1.00	Seeds of non-native plants commonly are carried by humans and their pets. Non-native plants can decrease plant species richness of the wetland. In the Kenai Peninsula of Alaska,significantly fewer nonnative species were found beyond a 500-m distance from a trailhead. High-use trails, especially those in open-canopied areas, exhibited the greatest numbers of nonnative species at the farthest distances from the trailhead and contained a greater number of less common nonnative species.	Core1pd
		<5% and no inhabited building is within 100 m of the AA.	0	1	0			
		<5% and inhabited building is within 100 m of the AA.	0	0	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0			
		5-50% and inhabited building is within 100 m of the AA.	0	2	0			
		50-95%, with or without inhabited building nearby.	0	4	0			
		>95% of the AA with or without inhabited building nearby.	1	5	5			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				1.00	See above.	Core2pd
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	3	3			
		5-50%.	0	2	0			
		50-95%.	0	1	0			
		>95% of the AA.	0	0	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0				Trampling of native vegetation by recreationists can decrease seed germination and increase vulnerability to invasion by more tolerant invasive plants and ultimately reduce native plant richness. These and other Best Management Practices (BMPs) potentially reduce such damage.	BMPsoils20
F66	Calcareous Fen	The AA is, or is part of, a calcareous fen. See the Plants_Calcar worksheet in the accompanying SuppInfo file for list of plant indicators (calciphiles). Enter 1 If more than two Strong or more than five Moderate calciphile species are present; otherwise enter 0, but if not able to identify those and no information, change to blank.	0				Calcareous fens often support more plant species than other wetlands of similar size, and the species they support are usually among the regionally rarest (Hinds 1983, Hill & Keddy 1992, Mullen et al. 2000, Hinds 2000, McClellan et al. 2003).	CalcFen15
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0.25			0.75	The germination of many plant species is triggered by the interaction of water conditions and season (light). Homogenization or alteration of the natural water regime can thus encourage invasive species at the expense of native flora (Zedler & Kercher 2004, Catford et al. 2011). Inundation at aberrant times of the year can reduce native plant diversity because most native species have evolved in close synchronization with natural seasonal water regimes. Any development that involves increasing the area of lawn or impervious surface is likely to increase runoff amount and concentrate it within shorter time periods, i.e. "pulses" "flashiness" (Booth & Jackson 1997, Booth et al. 2002, DeGasperi et al. 2009). This makes wetlands more susceptible to invasion by non-native plants (Magee & Kentula 2005). *In calculations, is excluded automatically (cell goes blank) if wetland has no surface water inflow.*	AltTime20
S2	Accelerated Inputs of Contaminants and/or Salts	Stressor subscore=	0.44			0.56	Increased dominance by fewer species, such as cattail and various invasive plants, often results from increased salinity in normally non-saline wetlands, and results in decreased native plant richness (Gleason & Euliss 1998).	Salt20
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	0.75			0.25	Deposition of only 0.25 to 0.5 centimeter of new sediment has been shown to significantly reduce species richness, emergence, and germination of wetland plants (Gleason et al. 2001),	SedDep20
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0.33			0.67	Even if vegetation is not removed, compaction of winter snow cover can damage vegetation (Keddy et al. 1979), and compaction of soil can inhibit plant growth by decreasing soil oxygen and altering drainage patterns. Soil disturbance also facilitates invasion by exotic species, and sedimentation limits the germination and growth of wetland plants (Wardrop & Brooks 1998, Mahaney et al. 2005).	SedDisturb20
#	**Benefit Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Rationale**	**Cell Name**
OF6	Herbaceous Uniqueness	The AA's vegetation cover is >10% herbaceous* but uplands within 5 km have <10% herbaceous cover. If so, enter "3" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 1 km have <10% herbaceous cover. If so enter "2" and continue to OF7. If not, consider: The AA's vegetation cover is >10% herbaceous* but uplands within 100 m of the wetland edge have <10% herbaceous cover. If so, enter "1". [* NOTE: Exclude lawns, row crops, heavily grazed lands, forest, shrublands. Include moss as well as grasslike plants in this use of "herbaceous vegetation"]	1			0.33	Dependency of herbaceous plant species on wetlands increases if no other herbaceous habitats are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	HerbUniq20
OF7	Woody Uniqueness	The AA's vegetation cover is >10% woody* but uplands within 5 km have <10% woody cover. If so, enter "3" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 1 km have <10% woody cover. If so enter "2" and continue to OF8. If not, consider: The AA's vegetation is >10% woody* but uplands within 100 m of the wetland edge have <10% woody cover. If so, enter "1" [* NOTE: woody cover = trees & shrubs taller than 1 m.]	0			0.00	Dependency of woody plant species on a particular wooded wetland (and thus its importance) increases if no other wooded areas are available in the vicinity. *In calculations, the highest score is given for uniqueness judged at the 5 km scale.*	WoodyUniq20
OF29	Species of Conservation Concern	Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0			0.00	These wetland species are particularly valued because of their rarity and/or declining populations as listed by agencies.	RarePsp20
	Function Score for Pollinator Habitat					0.72	Wetlands with greater plant richness are likely to be more valuable to pollinators if other factors already suggest the wetland has high capacity to support pollinators.	ScorePOLf
	Function Score for Songbird, Raptor, & Mammal Habitat					0.85	Wetlands with greater plant richness are likely to be more valuable to supporting a variety of songbirds and mammals if other factors already suggest the wetland has high capacity to support those.	ScoreSBM

Species - Area	0.57	AVERAGE (Width, Size, SizeVegConn, SatPct)	SppArea
Landscape	0.85	AVERAGE (Beaver, NatVegCA, BuffLUpd, PondScape, PondProx)	Lscape
Aquatic Fertility	0.49	AVERAGE [MAX(CalcFen, Conduc, Acidic), Inflow, AVERAGE (Interspers, Fluc, SeasWpct, Groundw, Depth)]	AqFertilPD
Terrestrial Fertility	0.60	AVERAGE (Nfix, SoilTex, Karst, GDD)	TerrFertilPD
Competition/ Light	0.75	AVERAGE[Invas, AVERAGE(DecidCov, WoodyHtDiv, WoodHerbMix, HerbDom, Burn, Girreg)]	CompetPD
Stressors	0.69	[AVERAGE (Core1, Core2, BMPsoils, WeedSource) + AVERAGE(PopCtr, DistRd) + MIN(AltTime, Salt, SedDep, SedDisturb)]/3	StressPD

Function Score for Native Plant Habitat	F	6.35	IF((InvasDom1=1), 0, ELSE: (4*SppArea + 3*CompetPD + 2*AqFertilPD + 2*TerrFertilPD + LscapePD + StressPD)/13)
Benefits Score for Native Plant Habitat	B	6.35	IF((RarePlant=1),1, ELSE: AVERAGE(SBMscore, MAX(HerbUniq, WoodyUniq), ScorePOL)

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Public Use & Recognition	Prior designation of the wetland, by a natural resource or environmental protection agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research. The model assigns higher scores to greater visitor use. It does not account for some areas being valued more highly (e.g., as wilderness) because they have fewer visitors.	PU						
#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	If accessible, wetlands closer to population centers are likely to be visited by more people on foot.	PopCtrDisPU
		<100 m.	0	5	0			
		100 - 500 m.	0	3	0			
		0.5- 1 km.	0	2	0			
		1 - 5 km.	1	1	1			
		>5 km.	0	0	0			
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.13	The frequency of most recreational visits declines with increasing distance from roads.	DistRdPU
		<10 m.	0	8	0			
		10 - 25 m.	0	5	0			
		25 - 50 m.	0	4	0			
		50 - 100 m.	0	3	0			
		100 - 500 m.	0	2	0			
		>500 m.	1	1	1			
OF15	Tidal Proximity	The distance from the AA edge to the closest tidal water body (regardless of its salinity) is:				0.33	People are naturally drawn to this region's coastal shorelines for recreation and occasionally for relief from summer heat.	TidalProxPU
		<100 m.	0	6	0			
		100 m - 1 km.	0	5	0			
		1 - 5 km.	0	4	0			
		5-10 km.	0	3	0			
		10-40 km.	1	2	2			
		>40 km.	0	0	0			
OF33	Other Conservation Designation	The AA is all or part of an area designated by government, First Nations, or the Nature Conservancy of Canada (NCC) for its exceptional ecological features or highly intact natural conditions. With Provincial Landscape Viewer, see Protected Areas. Enter: yes= 1, no= 0. If uncertain, consult NCC and agencies for more recent information.	0			0.00	This reflects more widespread recognition of particular wetlands or their surroundings.	ConsDesig1
OF34	Conservation Investment	The AA is part of or contiguous to a wetland on which public or private organizational funds were spent to preserve, create, restore, or enhance the wetland (excluding mitigation wetlands). Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank (not 0).	0			0.00	Prior public investment for these purposes requires greater protection.	ConsInvest
OF35	Mitigation Investment	The AA is all or part of a mitigation site used explicitly to offset impacts elsewhere. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Mitigation wetlands represent an investment of funds in the public's interest, which should not be wasted.	MitigaSite
OF36	Sustained Scientific Use	Plants, animals, or water in the AA have been monitored for >2 years, unrelated to any regulatory requirements, and data are available to the public. Or the AA is part of an area that has been designated by an agency or institution as a benchmark, reference, or status-trends monitoring area. Ask the property owner. Enter: yes= 1, no= 0. If no information, change to blank.	0			0.00	Collection of long term data from wetlands is in the public interest partly because it can lead to more effective and fair regulations.	SciUse
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				0.25	Public ownership generally implies greater public use.	Ownership
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	4	0			
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0			
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	2	0			
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	1	1			
F23	Lacustrine Wetland	The vegetated part of the AA is within or adjacent to a body of non-tidal standing open water whose size exceeds 8 hectares during most of a normal year.	0				*In calculations, if wetland is associated with a lake it counts positively; if not, this indicator is ignored in the calculations.*	LakePU
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	Public enjoyment of wetlands is assumed to be greater when most of the wetland can be seen without obstruction by dense shrubs or other features.	Visibility
		<25%.	0	0	0			
		25-50%.	0	1	0			
		>50%.	1	2	2			
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.67	Lack of physical barriers, provision of trails, and interpretive signs encourage greater public use of areas. However, some apparent barriers (e.g., deep water, dense brush) may be barriers only to summer recreation; frozen wetlands may enjoy considerable wintertime use.	RecreaPot
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	1				
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1				
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1				

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	The portion of a wetland that is accessible to visitors is assumed to be an important determinant of frequence of visitation	Core1PU
		<5% and no inhabited building is within 100 m of the AA.	0	4	0			
		<5% and inhabited building is within 100 m of the AA.	0	5	0			
		5-50% and no inhabited building is within 100 m of the AA.	0	2	0			
		5-50% and inhabited building is within 100 m of the AA.	0	3	0			
		50-95%, with or without inhabited building nearby.	0	1	0			
		>95% of the AA with or without inhabited building nearby.	1	0	0			
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.00	See above.	Core2PU
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	0	0			
		5-50%.	0	1	0			
		50-95%.	0	2	0			
		>95% of the AA.	0	3	0			
F62	BMP - Soils	Boardwalks, paved trails, fences or other infrastructure and/or well-enforced regulations appear to effectively prevent visitors from walking on soil within nearly all of the AA when the soil is unfrozen. Enter "1" if true.	0				Such features and practices minimize damage to plants and wildlife and thus help sustain the natural features that attract people to wetlands.	BMPsoilsPU
F63	BMP - Wildlife Protection	Fences, observation blinds, platforms, paved trails, exclusion periods, and/or well-enforced prohibitions on motorised boats, off-leash pets, and off road vehicles appear to effectively exclude or divert visitors and their pets from the AA at critical times in order to minimize disturbance of wildlife (except during hunting seasons). Enter "1" if true.	0				See above.	BMPwildPU

Convenience	0.27	AVERAGE(Ownership, Visibility, RdDist, Core1PU, Core2PU, ElevPU, PopCtrDisPU, TidalProxPU)	Conven
Investment	0.00	MAX(MitigaSite, ConsInvest, ConsDesig, SciUse)	Invest
Recreation Potential	0.67	AVERAGE(RecreaPoten, BMPsoils, BMPwildlife, LakePU)	RecPot

Benefits Score for Public Use & Recognition	B	3.13	AVERAGE(Convenience, Invest, RecPot)

Wetland Ecological Condition	The integrity or health of a wetland, as defined operationally by its vegetation composition and richness of native species. More broadly, the similarity of a wetland's structure, composition, and function with that of a reference wetland of the same type and landscape setting, operating within the bounds of natural or historical disturbance regimes (Adamus 1996).	EC					

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				0.63	Rare native species are usually the first to disappear after a wetland is subjected to alteration of its water quality, hydrologic connectivity, or normal water or sediment regimes. Thus, their absence is sometimes indicative of past or ongoing impacts to the wetland's processes and condition.	RareAll
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0	1	0			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				1.00	Lack of vegetative cover suggests a wetland may be in poor condition as a result of human-related impacts, but could also be the result of natural limitations or events.	BareGpct
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	3	3			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	2	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	1	0			
		Other conditions.	0	0	0			
		Not applicable. Surface water (either open or obscured by emergent plants) covers all of the AA all the time.	0					
F12	Ground Irregularity	Imagine the AA without any living vegetation. Excluding the portion of the AA that is always under water, the number of hummocks, small pits, raised mounds, animal burrows, ruts, gullies, natural levees, microdepressions, and other areas of peat or mineral soil that are raised or depressed >10 cm compared to most of the area within a few meters surrounding them is:				0.50	Under natural unimpacted conditions, many but not all wetlands will have extensive microtopography.	GirregCQ
		Few or none (minimal microtopography; <1% of the land has such features, or entire AA is always water-covered).	0	0	0			
		Intermediate.	1	1	1			
		Several (extensive micro-topography).	0	2	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Strong dominance by one or a few species, even if those are natives, is sometimes an indicator of impaired ecological condition. However, newly created wetlands often have high richness of colonizing species. *In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.*	HerbDom1
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Alteration of a wetland's water quality or its normal water or sediment regime is usually followed by invasion by non-native species, making these an indicator of past or ongoing alteration.	EmSens1_C
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3	0			
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F41	Floating Algae & Duckweed	At some time of the year, mats of algae and/or duckweed are likely to cover >50% of the AA's otherwise-unshaded water surface, or blanket >50% of the underwater substrate. If true, enter "1" in next column. If untrue or uncertain, enter "0".	0				The model considers the presence (1) of this condition to indicate a somewhat degraded condition, but does not consider the absence (0) of this indicator a sign that a wetland is necessarily undegraded, so *if the condition is absent, the score is changed to blank and is not used by the model.*	OverRich

Score for Wetland Ecological Condition (Integrity)	EC	9.17	(MAX(RareAll, EmSens) + AVERAGE(HerbDom, GirregCQ, OverRich, BareGpct))/ 2

Wetland Sensitivity	A wetland's lack of intrinsic resistance and resilience to human and natural stressors (higher score = more sensitive).	Sen						
#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF3	Ponded Water & Wetland Within 1 km.	The area of wetlands and surface water ponded during most of the growing season that is both (1) in or adjacent to the AA and (2) within 1 km is:				0.60	Larger wetlands have a greater proportional area that is buffered against external disturbances and thus may be considered less sensitive. Small wetlands or more vulnerable to drying up as a result of climate change or changes in groundwater flow patterns, and many are poorly-buffered chemically against acifiying chemical inputs from precipitation (Freda 1986).	WetSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	1	3	3			
		1 to 10 hectares.	0	3	0			
		10 to 100 hectares.	0	2	0			
		>100 hectares.	0	0	0			
OF4	Size of Largest Nearby Vegetated Tract or Corridor	The largest vegetated patch or corridor that includes the AA's vegetation plus all adjacent upland vegetation that is not lawn, row crops, heavily grazed lands, conifer plantation is:				0.40	See above.	NatVegSize_S
		<0.01 hectare (about 10 m x 10 m).	0	5	0			
		0.01 - 0.1 hectare.	0	4	0			
		0.1 - 1 hectare.	0	3	0			
		100 to 1000 hectares.	1	2	2			
		>1000 hectares. [This is nearly always the answer in relatively undeveloped landscapes.]	0	0	0			
OF5	Distance to Large Vegetated Tract	The minimum distance from the edge of the AA to the edge of the closest vegetated land (but excluding row crops, lawn, conifer plantation) larger than 375 hectares (about 2 km on a side), is:				0.00	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if they are contiguous with or close to other natural cover, especially if it is extensive, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegProx_S
		<50 m, and not separated from the 375-ha vegetated area by any width of paved roads, stretches of open water, row crops, bare ground, lawn, or impervious surface. Or the AA itself contains >375 ha of vegetation. [This is often the answer in relatively undeveloped landscapes.]	1	0	0			
		<50 m, but completely separated from the 375-ha vegetated area by those features, and AA does not contain >375 ha of vegetation.	0	1	0			
		50-500 m, and not separated.	0	2	0			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 5 km, and not separated.	0	4	0			
		0.5 - 5 km, but separated by those features.	0	5	0			
		None of the above (the closest patches or corridors which are that large are >5 km away).	0	6	0			
OF8	Local Vegetated Cover Percentage	Draw a 5-km radius circle measured from the center of the AA. Ignoring all permanent water in the circle, the percent of the remaining area that is wooded or unmanaged herbaceous vegetation (NOT lawn, row crops, bare or heavily grazed land, clearcuts, or conifer plantations) is:				0.40		VegPctScape_
		<5% of the land.	0	5	0			
		5 to 20% of the land.	0	4	0			
		20 to 60% of the land.	0	3	0			
		60 to 90% of the land.	1	2	2			
		>90% of the land. SKIP to OF10.	0	0	0			
OF13	Distance to Ponded Water	The distance from the AA center to the closest (but separate) ponded water body visible in GoogleEarth imagery is:				0.33	See above.	PondProx_S
		<50 m, and not separated by any width of paved roads, stretches of open water, row crops, lawn, bare ground, or impervious surface.	0	0	0			
		<50 m, but completely separated by those features.	0	1	0			
		50-500 m, and not separated.	1	2	2			
		50-500 m, but separated by those features.	0	3	0			
		0.5 - 1 km, and not separated.	0	4	0			
		0.5 - 1 km, but separated by those features.	0	5	0			
		None of the above (the closest patches or corridors that large are >1 km away).	0	6	0			
OF14	Distance to Large Ponded Water	The distance from the AA center to the closest (but separate) non-tidal body of water that is ponded during most of the year and is larger than 8 hectares during most of a normal year is:				0.50	Large water bodies often support high richness of wetland plants and animals, such that if a wetland is distant from a lake, recolonization of the wetland following impacts is likely to be slower.	LakeProx_S
		<100 m.	0	0	0			
		100 m - 1 km.	0	1	0			
		1 -2 km.	0	2	0			
		2-5 km.	1	3	3			
		5-10 km.	0	4	0			
		>10 km.	0	6	0			
OF16	Upland Edge Contact	Select one:				1.00	Longer wetland-upland edge relative to wetland area (i.e., convoluted edge) implies a wetland may be more vulnerable to invasive species, higher evapotranspiration, and other disturbances characteristic of adjoining uplands.	UpEdge_S
		The AA has no upland edge (or upland is <1% of perimeter). The AA is entirely surrounded by (& contiguous with) other wetlands or water.	0	0	0			
		1-25% of the AA's perimeter abuts upland (including filled areas). The rest adjoins other wetlands or water that is mostly wider than the AA.	0	2	0			
		25-50% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	3	0			
		50-75% of the AA's perimeter abuts upland. The rest adjoins other wetlands or water that is mostly wider than the AA.	0	4	0			
		More than 75% of the AA's perimeter abuts upland. Any remainder adjoins other wetlands or water that is mostly wider than the AA. This will be true for most assessments done with WESP-AC.	1	5	5			
OF18	Relative Elevation in Watershed	In Google Earth, enable the Terrain layer (lower left menu) and open the NS_Watersheds Secondary KMZ file that accompanies this calculator. Then determine the AA's approximate elevation (bottom right, NOT the "eye alt"). Then move cursor around to determine the watershed's maximum and minimum elevation. Divide the AA's elevation by the (max-min).				0.98	Wetlands near headwaters have less exposure to waterborne colonizing plant propagules, thus potentially longer recovery times and greater sensitivity.	Elev_S

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
OF22	Wetland as a % of Its Contributing Area (Catchment)	From a topographic map and field observations, estimate the approximate boundaries of the catchment (CA) of the entire wetland of which the AA may be only a part. Then adjust those boundaries if necessary based on your field observations of the surrounding terrain, and/or by using procedures described in the Manual. Divide the area of the wetland (not just the AA) by the approximate area of its catchment excluding the area of the wetland itself. When doing the calculation, if ponded water is adjacent to the wetland, include that in the wetland's area. The result is:				0.67	The water regimes of wetlands whose catchments are small relative to wetland size are often more precarious and sensitive to landscape alterations (Fitzgerald et al. 2003).	CUratio_S
		<0.01, or catchment size unknown due to stormwater pipes that collect water from an indeterminate	0	0	0			
		0.01 to 0.1.	0	1	0			
		0.1 to 1.	1	2	2			
		>1 (wetland is larger than its catchment (e.g., wetland with flat surrounding terrain and no inlet, or is entirely isolated by dikes, or is a raised bog).	0	3	0			
OF27	Growing Degree Days	In Google Earth, open the KMZ file that accompanies this calculator, called NS_GrowingDegreeDays. Place your cursor over the AA and left-click. From the pop-up window, enter the GRIDCODE number in the next column.	1903			0.87	Wetlands in regions with colder temperatures and shorter growing seasons take more time to recover from disturbances, and thus may be considered to be more sensitive.	GDD_S
OF29	Species of Conservation Concern	Within the past 10 years, in the AA (or in its adjoining waters or wetland), qualified observers have documented [mark all applicable]:				1.00	Individuals belonging to species that are on the margins of their geographic range at this location tend to be more sensitive to some types of environmental disturbances.	RareSpp_S
		Presence of one or more of the plant species listed in the Plants_Rare worksheet of the accompanying SuppInfo file, or the AA is within a mapped Atlantic Coastal Plain Flora Buffer (go to Provincial Landscape Viewer> Wildlife> Special Management Practice Zones).	0	1	0			
		Presence of one or more of the amphibian or reptile species (AM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the waterbird species (WBF, WBN) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file.	0	1	0			
		Presence of one or more of the nesting songbird or raptor species (SBM) of conservation concern as listed in the Wildlife_Rare worksheet of the accompanying SuppInfo file, during their nesting season (May-July for most species).	1	1	1			
		None of the above, or no data.	0					
F1	Wetland Type	Follow the key below and mark the ONE row that best describes MOST of the vegetated part of the AA:				0.50	Negative consequences of drought are greatest in peatlands, where large stores of organic matter in soils can be volatilised. Being groundwater dependent, fens are also sensitive to water table changes. Mosses and woody vegetation (shrub and forested wetlands) require many years to fully re-establish if removed or killed, i.e., resilience is less than for herbaceous vegetation. As compared with wooded wetlands, moss wetlands and seasonal marshes receive more off-road vehicle traffic with consequent degradation of soil and vegetation (Loomis & Lieberman 2006). Floodplain wetlands and marshes tend to be better buffered chemically than fens and especially bogs (Wood & Rubec 1989, Wisheu & Keddy 1994). Marshes tend to be more resilient partly because of their relatively high nutrient levels. Fens in some regions tend to be less sensitive to invasion by non-native plants (Magee & Kentula 2005), especially when shaded by a forest canopy. However, they are often highly sensitive to alteration of local water tables (Fitzgerald et al. 2003).	WettypeS
		A. Moss and/or lichen cover more than 25% of the ground. Often dominated by ericaceous shrubs (e.g., Labrador tea) or other acid-tolerant plants (e.g., bog cranberry, pitcher plant, sundew, orchids). Substrate is mostly undecomposed peat. Choose between A1 and A2 and mark the choice with a 1 in						
		A1. Surface water is usually absent or, if present, pH is typically <4.5 and conductivity is usually <100 µS/cm (<64 ppm TDS). Trees are absent or nearly so. Sedge cover usually sparse or absent but cottongrass and/or lichen cover may be extensive, as well as cloudberry, lingonberry, sheep laurel, and a sedge (Carex rariflora). Wetland surface and surrounding landscape are seldom sloping and wetland often is domed (convex). Inlet and outlet channels are usually absent. If known, pH of peat is <4.0.	0	4	0			
		A2. Not A1. Surface water, if present, has pH typically >4.5 and conductivity is usually >100 µS/cm (>64 ppm TDS). Sedge cover is usually extensive, and/or tree and tall shrub cover is extensive. Sometimes at toe of slope or edge of water body. An exit channel is usually present. Wetter than A1 and peat depth may be shallower (<2 m).	1	2	2			
		B. Moss and/or lichen cover less than 25% of the ground. Soil is mineral or decomposed organic (muck). Choose between B1 and B2 and mark the choice with a 1 in their adjoining column:						
		B1. Trees and shrubs taller than 1 m comprise more than 25% of the vegetated cover. Surface water is mostly absent or inundates the vegetation only seasonally (e.g., vernal pools or floodplain).	0	3	0			
		B2. Not B1. Tree & tall shrubs comprise less than than 25% of the vegetated cover. Vegetation is mostly herbaceous, e.g., cattail, bulrush, burreed, pond lily, horsetail. Surface water may be extensive and fluctuates seasonally, being either persistent or drying up partly or entirely.	0	1	0			
F3	Woody Height & Form Diversity	Following EACH row below, indicate with a number code the percentage of the living vegetation in the AA which is occupied by that feature (6 if >95%, 5 if 75-95%, 4 if 50-75%, 3 if 25-50%, 2 if 5-25%, 1 if <5%, 0 if none). If the vegetated part of the AA is largely herbaceous (non-woody) vegetation, these percentages should not sum to 100%.				0.17	Tree cover is slower to recover than cover of herbaceous plants, making forested wetlands less resilient. *In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.*	TreeCovS
F5	Woody Diameter Classes	Mark ALL the types that comprise >5% of the woody canopy cover in the AA or >5% of the wooded areas (if any) along its upland edge (perimeter). The edge should include only the trees whose canopies extend into the AA.					Larger-diameter trees are generally older, implying that recovery (resilience) from their loss will take longer than from loss of young trees. Resilience is one component of wetland sensitivity. In calculations, is excluded automatically (cell goes blank) if few or no trees are present.	TreeDBHs
		coniferous, 1-9 cm diameter and >1 m tall.	0	0	0			
		broad-leaved deciduous 1-9 cm diameter and >1 m tall.	0	0	0			
		coniferous, 10-19 cm diameter.	0	1	0			
		broad-leaved deciduous 10-19 cm diameter.	0	1	0			
		coniferous, 20-40 cm diameter.	0	2	0			
		broad-leaved deciduous 20-40 cm diameter.	0	2	0			
		coniferous, >40 cm diameter.	0	3	0			
		broad-leaved deciduous >40 cm diameter.	0	3	0			
F4	Dominance of Most Abundant Shrub Species	Determine which two woody plant species comprise the greatest portion of the low (<3 m) woody cover . Then choose one:					Wetlands with fewer species may be less resistant to environmental change, and less resilient following disturbances. *In calculations, is excluded automatically (cell goes blank) if little or no shrub cover is present.*	WoodySens2_
		those species together comprise > 50% of such cover.	0	0	0			
		those species together do not comprise > 50% of such cover.	0	1	0			
F6	Height Class Interspersion	Follow the key below and mark the ONE row that best describes MOST of the AA:					High dispersion (fragmentation) of woody cover suggests recolonization of wetlands following disturbance may take longer when future disturbances occur, due to less intact corridors with similar cover types. In calculations, is excluded automatically (cell goes blank) if little or no woody cover is present.	ShrubPattS
		A. Neither the vegetation taller than 1 m nor the vegetation shorter than that comprise >70% of the vegetated part of the AA. They each comprise 30-70%. Choose between A1 and A2 and mark the choice with a 1 in the adjoining column. Otherwise go to B below.						
		A1. The two height classes are mostly scattered and intermixed throughout the AA.	0	3	0			
		A2. Not A1. The two height classes are mostly in separate zones or bands, or in proportionately large clumps.	0	2	0			
		B. Either the vegetation shorter than 1 m comprises >70% of the vegetated part of the AA, or the vegetation taller than that does. One size class might even be totally absent. Choose between B1 and B2 and mark the choice with a 1 in the adjoining column:						
		B1. The less prevalent height class is mostly scattered and intermixed within the prevalent one.	0	1	0			
		B2. Not B1. The less prevalent height class is mostly located apart from the prevalent one, in separate zones or clumps, or is completely absent.	0	0	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F9	N Fixers	The percentage of the AA's vegetated cover that contains nitrogen-fixing plants (e.g., alder, sweetgale, clover, lupine, alfalfa, other legumes) is:				0.40	Because of its ability to fertilize soil, alder can speed biological recovery following disturbance [Gomi et al. 2006]. Wetlands without alder may be slower to recover and thus more sensitive.	NfixS
		<1% or none.	0	0	0			
		1-25% of the vegetated cover, in the AA or along its water edge (whichever has more).	1	2	2			
		25-50% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	3	0			
		50-75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	4	0			
		>75% of the vegetated cover, in the AA or along its water edge (whichever has more).	0	5	0			
F11	% Bare Ground & Thatch	Consider the parts of the AA that lack surface water at the driest time of the growing season. Viewed from directly above the ground layer, the predominant condition in those areas at that time is:				0.00	If vegetation cover in a wetland is already sparse, it is often more susceptible to further loss from erosion and altered microclimate.	Gcover_S
		Little or no (<5%) bare ground is visible between erect stems or under canopy anywhere in the vegetated AA. Ground is extensively blanketed by dense thatch, moss, lichens, graminoids with great stem densities, or plants with ground-hugging foliage.	1	0	0			
		Slightly bare ground (5-20% bare between plants) is visible in places, but those areas comprise less than 5% of the unflooded parts of the AA.	0	1	0			
		Much bare ground (20-50% bare between plants) is visible in places, and those areas comprise more than 5% of the unflooded parts of the AA.	0	2	0			
		Other conditions.	0	3	0			
F14	Soil Texture	In parts of the AA that lack persistent water, the texture of soil in the uppermost layer is mostly: [To determine this, use a trowel to check in at least 3 widely spaced locations, and use the soil texture key (in Appendix A of the Manual).]				1.00	Organic soils are particularly sensitive because slight changes in the water table often cause rapid decomposition and/or compaction (subsidence) of this substrate, resulting in major shifts in characteristic plants and animal species as well as biogeochemical processes. Coarse soils are most resistant to compaction, though they are less moisture-retentive and dry out quickly.	SoilTex_S
		Loamy: soils that may contain a little fine grit and do not make a "ribbon" longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Fines: includes silt, clay, silt, soils that make a ribbon longer than 2 cm when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	1	0			
		Deep Peat, to 40 cm depth or greater.	0	3	0			
		Shallow Peat or organic <40 cm deep.	1	4	4			
		Coarse: includes sand, loamy sand, gravel, cobble, soils that do not make a ribbon when moistened, rolled, squeezed, and extended between thumb and forefinger.	0	0	0			
F19	Dominance of Most Abundant Herbaceous Species	Determine which two herbaceous species comprise the greatest portion of the herbaceous cover (excluding mosses and floating-leaved aquatic plants). Then choose one of the following:				1.00	Simply because they tend to have more species, wetlands with a predominance of native species have more species to lose and thus could be considered to be more sensitive to impacts. In contrast, once wetlands become dominated by non-native (exotic) species, the plant community structure is simplified (e.g., Perkins & Willson 2005). Non-natives tend to have broad environmental tolerances, so wetlands dominated by them and thus having low species richness are more resistant to further change (Werner & Zedler 2002, Wigand et al. 2003). By itself, increased species richness in a wetland does not always confer increased resistance (decreased sensitivity) of a wetland's functions to artificial changes (e.g., Engelhardt & Kadlec 2001). In calculations, is excluded automatically (cell goes blank) if little or no herbaceous cover is present.	HerbDom2
		those species together comprise > 50% of the areal cover of herbaceous plants at any time during the year.	0	0	0			
		those species together do not comprise > 50% of the areal cover of herbaceous plants at any time during the year.	1	1	1			
F20	Invasive Plant Cover	How extensive is the cover of invasive plant species in the AA? For species, see Plants_invasive worksheet in the accompanying SuppInfo file.				1.00	Wetlands already dominated by non-native invasive species are likely to be more resistant to further impacts to their remaining plant communities from additional invasive plant species (Werner et al. 2002, Wigand et al. 2003, Stohlgren et al. 2002),	EmSens1_S
		invasive species appear to be absent in the AA, or are present only in trace amount (a few individuals).	1	4	4			
		invasive species are present in more than trace amounts, but comprise <5% of herbaceous cover (or woody cover, if the invasives are woody).	0	3				
		invasive species comprise 5-20% of the herb cover (or woody cover, if the invasives are woody).	0	2	0			
		invasive species comprise 20-50% of the herb cover (or woody cover, if the invasives are woody).	0	1	0			
		invasive species comprise >50% of the herb cover (or woody cover, if the invasives are woody).	0	0	0			
F24	% of AA Without Surface Water	The percentage of the AA that never contains surface water during an average year (that is, except perhaps for a few hours after snowmelt or rainstorms), but which is still a wetland, is:				0.80	Wetlands that are only saturated (no surface water) are more susceptible to year-to-year differences in precipitation, runoff, and flow. Some also are more vulnerable to invasion by non-native upland plants (Magee & Kentula 2005). In contrast, persistently-inundated wetlands tend to be deeper and have more "buffer" against annual variation in available water.	SatPct_S
		<1% . In other words, all or nearly all of the AA is covered by water permanently or at least seasonally.	0	0	0			
		1-25% of the AA, or <1% but >0.01 ha never contains surface water.	0	1	0			
		25-50% of the AA never contains surface water.	0	2	0			
		50-75% of the AA never contains surface water.	0	3	0			
		75-99% of the AA never contains surface water, OR >99% and there is at least one persistently ponded water body larger than 1 ha in the AA.	1	4	4			
		99-100%. AND there is no persistently ponded water body larger than 1 ha within the AA. Enter "1" and SKIP to F42 (Channel Connection).	0	5	0			
F29	Predominant Depth Class	During most of the time when surface water is present during the growing season, its depth, averaged over the entire inundated part of the AA, is:				0.75	Decreases in water inputs will have the greatest impact on shallow wetlands, even causing parts of them to cease being wetlands, and causing major changes in species and biogeochemical processes in the remaining wetland. Also, among wetlands having the same area, shallow wetlands have less volume than deeper ones and thus experience less dilution of incoming contaminants. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.	Depth_S
		<10 cm deep (but >0).	0	4	0			
		10 - 50 cm deep.	1	3	3			
		0.5 - 1 m deep.	0	2	0			
		1 - 2 m deep.	0	1	0			
		>2 m deep. True for many fringe wetlands.	0	0	0			
F31	% of Water That Is Ponded (not Flowing)	During most times when surface water is present, the percentage that is (1) ponded (stagnant, or flows so slowly that fine sediment is not held in suspension) AND (2) is likely to be deeper than 0.5 m in some places, is:				0.20	Ponded waters are more susceptible to developing oxygen deficits and bioaccumulating contaminants. *In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year.*	IsoDry_S
		<5% of the water, or it occupies <100 sq.m cumulatively. Nearly all the surface water is flowing. SKIP to	1	1	1			
		5-30% of the water.	0	2	0			
		30-70% of the water.	0	3	0			
		70-95% of the water.	0	4	0			
		>95% of the water.	0	5	0			
F34	Width of Vegetated Zone within Wetland	At the time during the growing season when the AA's water level is lowest, the average width of vegetated area in the AA that separates adjoining uplands from open water within the AA is:				0.33	Narrow wetlands tend to be more susceptible to erosion from waves and currents. Their microclimate also is more precarious, trees are more subject to windthrow (Martin & Grotenfendt 2007, Bahuguna et al. 2010), and their wildlife may be more susceptible to predation. In narrow strips or small patches of vegetation, the native plant communities are more vulnerable to invasion from non-native species from adjoining lands (Hennings & Edge 2003). A study in Alberta found that non-native plants within forests there were most abundant between 15 and 50 ft from the edge, and some of those species were found up to 130 ft from the edge. Although larger patches of forest generally supported more non-natives species than smaller fragments, the smallest fragments had the greatest number of non-native species per square meter (Gignac & Dale 2007). Wooded buffers with dense vegetation tend to restrict wind-driven dispersal of seeds of non-native plants into the area protected by a buffer (Cadenzas & Pickett 2001). If the adjoining uplands are not forested, a greater proportion of the trees in narrow wetlands are subject to blowdown, and the wetland's plants and animals are more subject to extremes of the surrounding microclimate as well as disturbance from humans in nearby uplands. In calculations, is excluded automatically (cell goes blank) if wetland never has surface water during an average year, or has no open water.	VwidthAbs_S
		<1 m.	0	6	0			
		1 - 9 m.	0	4	0			
		10 - 29 m.	0	3	0			
		30 - 49 m.	1	2	2			
		50 - 100 m.	0	1	0			
		> 100 m, or open water is absent at that time.	0	0	0			

#	Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Rationales	Cell Name
F42	Channel Connection & Outflow Duration	The most persistent surface water connection (outlet channel or pipe, ditch, or overbank water exchange) between the AA and a downslope stream network is: [Note: If the AA represents only part of a wetland, answer this according to whichever is the least permanent surface connection: the one between the AA and the rest of the wetland, or the surface connection between the wetland and the downslope stream network.]				0.20	If a wetland lacks surface water outflow, nearly all contaminants that enter it will remain and be accumulated over time (Oberts 1977). This is particularly true of runoff-borne sediment, which can eventually fill a wetland and thus destroy it (Whited 2001, Whigham & Jordan 2003, Leibowitz 2003).	OutDura_S
		Persistent (surface water flows out for >9 months/year).	0	0	0			
		Seasonal (surface water flows out for 14 days to 9 months/year, not necessarily consecutive).	1	1	1			
		Temporary (surface water flows out for <14 days, not necessarily consecutive).	0	2	0			
		None -- but maps show a stream network downslope from the AA and within a distance that is less than the AA's length. SKIP to F47 (pH Measurement).	0	4	0			
		No surface water flows out of the wetland except possibly during extreme events (<once per 10 years). Or, water flows only into a wetland, ditch, or lake that lacks an outlet. SKIP to F47 (pH Measurement).	0	5	0			
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				1.00	Narrow outlets limit water outflow from a wetland and thus tend to cause the wetland to confine and accumulate sediment that has been washed in. The types of outlets described here are ones that typically are more constricted than natural channels. Natural channels usually have adjusted over time to local runoff and thus tend to be wider relative to volume of flow received. *In calculations, is excluded automatically (cell goes blank) if no outlet.*	Constric_S
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	2	2			
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary	0	0	0			
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	1	0			
F47	pH Measurement	The pH in most of the AA's surface water:					Low-pH wetlands are particularly sensitive to further acidification by acid rain. They are often darkly tea-coloured due to tannins associated with humic acids. *In calculations, the indicator score is set to 1 if pH is <5 or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.*	AcidicS
		Was measured, and is: [enter the reading in the column to the right.]	5.87					
		Was not measured but surface water is present and is darkly tea-coloured. Or if no surface water, then mosses and plants that indicate peatland (e.g., Labrador tea) are prevalent. Enter "1".	0					
		Neither of above. Enter "1".	0					
F48	TDS and/or Conductivity	The TDS (total dissolved solids) or conductivity off the AA's surface water is: (select the first true row with information):				1.00	Wetlands with lower conductivity or TDS generally (but not always) have lower alkalinity, which otherwise would buffer the wetland's chemistry against large changes induced by acid rain. In calculations, the indicator score is set to 1 if TDS<300 mg/L or conductivity is <600 µS/cm or if water is darkly tea-coloured; otherwise it is set to blank and ignored in the model calculations.	ConductivS
		TDS is: [Enter the reading in ppm or mg/L in the column to the right, if measured, or answer next row.]	9					
		Conductivity is [Enter the reading in µS/cm in the column to the right.]	20					
		Was not measured, but plants that indicate saline conditions cover much of the vegetated AA. Enter "1".	0					
		Neither of above	0					
F49	Beaver Probability	Use of the AA by beaver during the past 5 years is (select most applicable ONE):				1.00	Wetlands whose existence or extent depends on beaver are more sensitive in the sense that they may not be sustained naturally over time if beaver populations and associated beaver dams decline.	Beaver_S
		Evident from direct observation or presence of gnawed limbs, dams, tracks, dens, lodges, or extensive stands of water-killed trees (snags).	1	3	3			
		Likely based on known occurrence in the region and proximity to suitable habitat, which may include: (a) a persistent freshwater wetland, pond, or lake, or a perennial low or mid-gradient (<10%) channel, and (b) a corridor or multiple stands of hardwood trees and shrubs in vegetated areas near surface	0	2	0			
		Unlikely because site characteristics above are deficient, and/or this is a settled area or other area where beaver are routinely removed.	0	0	0			
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.67	Wetlands are likely to be more resilient (less sensitive, thus lower weighting factor) if large and/or surrounded by other natural landscapes, and/or if they are near other wetlands of the same type, because if an impact occurs to the wetland's vegetation, plant propagules from the surrounding landscape may speed recovery. Presence of natural vegetation in the surrounding landscape also may also help the wetland avoid the impact before it happens, by mitigating hydrologic and water quality alterations.	NatVegCUpct_
		<5%.	0	0	0			
		5 to 30%.	0	2	0			
		30 to 60%.	0	3	0			
		60 to 90%.	1	4	4			
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	6	0			
F54	Buffer Slope	The steepest and/or most disturbed part of the upland area that is within 30 m of the wetland and occupies >10% of that upland area has a percent slope of:				0.20	Wetlands adjoined by steep slopes are likely to be subject to more sediment and contaminant input, other factors being equal.	BuffSlope_S
		<1% (flat -- almost no noticeable slope) or all the area within 30 m of the AA edge is other wetlands.	0	0	0			
		2-5%.	1	1	1			
		5-30%.	0	2	0			
		>30%.	0	5	0			
F56	New or Expanded Wetland	Human actions within or adjacent to the AA have persistently expanded a naturally occurring wetland or created a wetland where there previously was none (e.g., by excavation, impoundment):					Man-made wetlands typically have less diverse vegetation and limited soil carbon, making them more sensitive to extreme natural events and slower to recover.	NewWet_S
		No.	0	0	0			
		Yes, and created or expanded 20 - 100 years ago.	0	1	0			
		Yes, and created or expanded 3-20 years ago.	0	2	0			
		Yes, and created or expanded within last 3 years.	0	3	0			
		Yes, but time of origin or expansion unknown.	0	1	0			
		Unknown if new or expanded within 20 years or not.	1					

Abiotic Resistance/ Sensitivity	0.44	AVERAGE [OutDura X AVERAGE(SatPct, CUratio, IsoDry, Depth, Constric), AVERAGE(BuffSlope, SoilTex, Beaver)]	AbioSens
Biotic Resistance/ Sensitivity	0.65	AVERAGE [AVERAGE[VwidthAbs, WetSize, (AVERAGE(EmSens, ShrubPattS, WoodySens2, Gcover, UpEdge)), RareSpp]	BioSens
Resilience/ Recovery Duration - Site Fertility & Climate	0.75	AVERAGE[GDD, AVERAGE(Wettype, Nfix, NewWet, Acidic, Conductiv)]	Fertility
Resilience/ Recovery Duration - Colonizer Availability Influence	0.54	AVERAGE(HerbDom, Elev, NatVegProx, NatVegSize, NatVegCUpct, PondProx, LakeProx)	Colonizer
Resilience/ Recovery Duration - Veg Growth Rate Influence	0.00	AVERAGE(TreeDBHs, TreeCover)	GrowthRate

Score for Wetland Sensitivity	SEN	4.75	AVERAGE(AbioSens, BioSens, Fertility, Climate, Colonizer, GrowthRate)

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Wetland Stressors	The degree to which a wetland is, or has recently been altered by, or exposed to risk from, factors capable of reducing one or more of its functions and which are primarily human-related.	STR				
#	**Stressor Indicators**	**Condition Choices**	**Data**	**Weight**	**Data x Weight**	**Stan-dardise**	**Cell Name**

#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
OF10	Distance by Road to Nearest Population Center	Measured along the maintained road nearest the AA, the distance to the nearest population center is:				0.20	PopCtrDist
		<100 m.	0	5	0		
		100 - 500 m.	0	3	0		
		0.5- 1 km.	0	2	0		
		1 - 5 km.	1	1	1		
		>5 km.	0	0	0		
OF11	Distance to Nearest Maintained Road	From the center of the AA, the distance to the nearest maintained public road (dirt or paved) is:				0.00	DistRd
		<10 m.	0	5	0		
		10 - 25 m.	0	4	0		
		25 - 50 m.	0	2	0		
		50 - 100 m.	0	1	0		
		100 - 500 m.	0	1	0		
		>500 m.	1	0	0		
OF12	Wildlife Access	Draw a circle of radius of 5 km from the center of the AA. If mammals and amphibians can move from the center of the AA to ALL other separate wetlands and ponds located within the circle without being forced to cross pavement (any width), lawns, bare ground, and/or marine waters, mark 1= yes can move to all, 0= no. Change to blank if there are no other wetlands within 5 km.	0			1.00	RdBox
OF20	Degraded Water Upstream	Sampling indicates a problem with concentrations of metals, hydrocarbons, nutrients, or other substances (excluding bacteria, acidic water, high temperatures) being present at levels harmful to aquatic life or humans, and:					ToxicData
		The condition is present within the AA.	0				
		The condition is present in waters within 1 km that flow into the AA, but has not been documented in the AA itself.	0				
		Sampling during both low water periods and times with high runoff (storms, snowmelt) indicates no problems in either the AA or inflowing	0				
		Data are insufficient (no or inadequate sampling within 1 km, or condition exists only at >1 km upstream). This is the situation for nearly all wetlands in this region.	1				
OF23	Unvegetated Surface in the Contributing Area	The proportion of the AA's contributing area (measured to no more than 1000 m upslope) that is comprised of buildings, roads, parking lots, other pavement, exposed bedrock, landslides, and other mostly-bare surface is about :				0.00	CAimperv
		<10%.	1	0	0		
		10 to 25%.	0	2	0		
		>25%.	0	3	0		
OF38	Ownership	Select the ONE ownership that covers the most of the AA. In Google Earth, open KMZ file called NS_Crownlands.Use more recent information if available.				1.00	OwnerSS
		New timber harvest, roads, mineral extraction, and intensive summer recreation (e.g., off-road vehicles) are permanently prohibited. Includes many publicly-owned Protected Lands, and private lands under long-term (30+ year) legal agreements to maintain nearly-unaltered conditions.	0	0	0		
		Ownership is public (e.g., municipal, Crown Reservations/Notations) but some or all of the above activities are allowed.	0	2	0		
		Ownership is private but public access is allowed, and/or a shorter-term conservation easement (whether renewable or not) is in place.	0	1	0		
		Ownership is private and owner does not allow access, or access permission unknown, and not a conservation easement.	1	2	2		
F21	Invasive Cover Along Upland Edge	Along the wetland-upland boundary, the percent of the upland edge (within 3 m upslope from the wetland) that is occupied by invasive plant species is:				0.00	WeedSource
		none of the upland edge (invasives apparently absent), or AA has no upland edge.	1	0	0		
		some (but <5%) of the upland edge.	0	1	0		
		5-50% of the upland edge.	0	2	0		
		most (>50%) of the upland edge.	0	3	0		
F43	Outflow Confinement	During major runoff events, in the places where surface water exits the AA or connected waters nearby, the water:				0.50	Constricted
		Mostly passes through a pipe, culvert, narrowly breached dike, berm, beaver dam, or other partial obstruction (other than natural topography) that does not appear to drain the wetland artificially during most of the growing season.	1	1	1		
		Leaves through natural exits (channels or diffuse outflow), not mainly through artificial or temporary features.	0	0	0		
		Is exported more quickly than usual due to ditches or pipes within the AA or connected to its outlet, or within 10 m of the AA's edge, which drain the wetland artificially, or water is pumped out of the AA.	0	2	0		
F52	Vegetated Buffer as % of Perimeter	Within a zone extending 30 m laterally from the AA's edge with upland and/or other wetlands, the percentage that contains perennial vegetation cover (except lawns, row crops, heavily grazed land, conifer plantations) is:				0.25	NatVegCA
		<5%.	0	4	0		
		5 to 30%.	0	3	0		
		30 to 60%.	0	2	0		
		60 to 90%.	1	1	1		
		>90%, or all the area within 30 m of the AA edge is other wetlands. SKIP to F55.	0	0	0		
F53	Type of Cover in Buffer	Within 30 m upslope of where the wetland transitions to upland, the upland land cover that is NOT perennial vegetation is mostly (mark ONE):				0.50	BuffDisturbTyp
		Impervious surface, e.g., paved road, parking lot, building, exposed rock.	0	2	0		
		Bare or nearly bare pervious surface or managed vegetation, e.g., lawn, row crops, unpaved road, dike, landslide.	1	1	1		
F57	Burn History	More than 1% of the AA's previously vegetated area:				0.00	BurnHist
		Burned within past 5 years.	0	4	0		
		Burned 6-10 years ago.	0	3	0		
		Burned 11-30 years ago.	0	2	0		
		Burned >30 years ago, or no evidence of a burn and no data.	1	0	0		
F58	Visibility	The maximum percentage of the wetland that is visible from the best vantage point on public roads, public parking lots, public buildings, or public maintained trails that intersect, adjoin, or are within 100 m of the AA (select one) is:				1.00	VisibWet
		<25%.	0	0	0		
		25-50%.	0	1	0		
		>50%.	1	2	2		
F59	Non-consumptive Uses - Actual or Potential	Assuming access permission was granted, select ALL statements that are true of the AA as it currently exists:				0.50	RecUse
		For an average person, walking is physically possible in (not just near) >5% of the AA during most of the growing season, e.g., free of deep water and dense shrub thickets.	1	1	1		
		Maintained roads, parking areas, or foot-trails are within 10 m of the AA, or the AA can be accessed part of the year by boats arriving via contiguous waters.	1	1	1		
		Within or near the AA, there is an interpretive center, trails with interpretive signs or brochures, and/or regular guided interpretive tours.	0	1	0		
		The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]	0	1	0		

#	Stressor Indicators	Condition Choices	Data	Weight	Data x Weight	Stan-dardise	Cell Name
F60	Unvisited Core Area	The percentage of the AA almost never visited by humans during an average growing season probably comprises: [Note: Only include the part actually walked or driven (not simply viewed from) with a vehicle or boat. Do not include visitors on trails outside of the AA unless more than half the wetland is visible from the trails and they are within 30 m of the wetland edge. In that case include only the area occupied by the trail.]				0.00	Core1
		<5% and no inhabited building is within 100 m of the AA.	0	5	0		
		<5% and inhabited building is within 100 m of the AA.	0	5	0		
		5-50% and no inhabited building is within 100 m of the AA.	0	3	0		
		5-50% and inhabited building is within 100 m of the AA.	0	2	0		
		50-95%, with or without inhabited building nearby.	0	1	0		
		>95% of the AA with or without inhabited building nearby.	1	0	0		
F61	Frequently Visited Area	The part of the AA visited by humans almost daily for several weeks during an average growing season probably comprises: [See note above.]				0.00	Core2
		<5%. If F60 was answered ">95%" (mostly never visited), SKIP to F64.	1	0	0		
		5-50%.	0	1	0		
		50-95%.	0	3	0		
		>95% of the AA.	0	3	0		
S1	Aberrant Timing of Water Inputs	Stressor subscore=	0			0.25	AltTiming
S2	Accelerated Inputs of Contaminants and/or	Stressor subscore=	0			0.44	Toxic
S3	Accelerated Inputs of Nutrients	Stressor subscore=	0			0.00	Enrich
S4	Excessive Sediment Loading from Contributing Area	Stressor subscore=	1			0.75	SedLoad
S5	Soil or Sediment Alteration Within the Assessment Area	Stressor subscore=	0			0.33	SoilDisturb

Hydrologic Stressors	0.38	AVERAGE(AltTiming, Constricted)	HydroStress
Water Quality Stressors	0.34	AVERAGE(Toxic, ToxicData, Enrich, SedLoad, SoilDisturb, CAimperv, BuffDisturbTyp)	WQstress
Fragmentation Stressors	0.42	AVERAGE(NatVegCA, RdBox, WeedSource)	FragStress
Disturbance Stressors	0.34	AVERAGE(RecUse, Core1, Core2, DistRd, VisibWet, PopCtrDist, Owner, BurnHist)	DisturbStress

Score for Stressors to Wetland	S	3.92	(MAX(HydroStress, WQstress, FragStress, DisturbStress)) + AVERAGE(HydroStress, WQstress, FragStress, DisturbStress))/2

Assessment Area (AA) Results:

Wetland ID: WL-8-WM

Date: July 27, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.567802 -63.743338

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.26	Lower	5.36	Moderate	4.38	2.38
Stream Flow Support (SFS)	0.97	Lower	0.00	Lower	0.78	0.00
Water Cooling (WC)	6.75	Higher	0.96	Lower	4.50	0.52
Sediment Retention & Stabilisation (SR)	3.24	Lower	1.30	Moderate	4.73	0.64
Phosphorus Retention (PR)	2.15	Lower	0.86	Lower	5.09	0.67
Nitrate Removal & Retention (NR)	3.57	Moderate	2.22	Lower	5.35	2.22
Carbon Sequestration (CS)	0.87	Lower			5.61	
Organic Nutrient Export (OE)	8.44	Higher			5.52	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.91	Higher	3.50	Moderate	5.90	3.13
Amphibian & Turtle Habitat (AM)	3.64	Moderate	4.17	Moderate	5.03	5.20
Waterbird Feeding Habitat (WBF)	5.05	Moderate	5.00	Moderate	3.84	5.00
Waterbird Nesting Habitat (WBN)	4.35	Moderate	5.00	Higher	3.15	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.76	Higher	5.00	Moderate	6.75	5.00
Pollinator Habitat (POL)	7.89	Moderate	0.00	Lower	6.54	0.00
Native Plant Habitat (PH)	3.10	Lower	4.43	Lower	5.14	4.43
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			8.37	Higher		4.56
Wetland Ecological Condition (EC)			4.78	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			4.68	Moderate		2.43
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.26	Lower	5.36	Moderate	4.38	2.38
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.01	Moderate	1.84	Lower	5.40	1.70
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.98	Higher	2.49	Lower	5.04	2.17
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.83	Moderate	3.92	Moderate	3.72	4.12
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.07	Higher	4.07	Lower	6.45	4.07
WETLAND CONDITION (EC)			4.78	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			6.52	Moderate		3.50

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	17.47103976	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	5.552161756	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	17.40359826	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	14.9950826	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	28.78744479	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-9a/9b-WM

Date: July 13, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.563698 -63.750862

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	3.17	Lower	10.00	Higher	4.31	5.50
Stream Flow Support (SFS)	1.06	Lower	0.00	Lower	0.85	0.00
Water Cooling (WC)	7.80	Higher	1.26	Lower	5.20	0.69
Sediment Retention & Stabilisation (SR)	3.66	Moderate	2.08	Moderate	5.05	1.02
Phosphorus Retention (PR)	2.21	Lower	1.71	Moderate	5.13	1.33
Nitrate Removal & Retention (NR)	3.39	Moderate	2.78	Lower	5.22	2.78
Carbon Sequestration (CS)	1.95	Lower			6.12	
Organic Nutrient Export (OE)	9.82	Higher			6.42	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	4.02	Moderate	3.68	Moderate	5.13	3.23
Amphibian & Turtle Habitat (AM)	5.66	Moderate	3.18	Moderate	6.09	4.38
Waterbird Feeding Habitat (WBF)	4.00	Moderate	2.50	Lower	3.04	2.50
Waterbird Nesting Habitat (WBN)	3.60	Moderate	2.50	Moderate	2.61	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	8.74	Higher	2.50	Lower	7.61	2.50
Pollinator Habitat (POL)	8.91	Higher	0.00	Lower	7.38	0.00
Native Plant Habitat (PH)	2.21	Lower	5.00	Lower	4.78	5.00
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			10.00	Higher		6.10
Wetland Ecological Condition (EC)			5.65	Moderate		7.92
Wetland Stressors (STR) (higher score means more stress)			7.09	Higher		3.59
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	3.17	Lower	10.00	Higher	4.31	5.50
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.23	Moderate	2.48	Lower	5.75	2.24
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.75	Higher	2.66	Lower	5.41	2.26
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.16	Moderate	2.41	Moderate	4.22	3.13
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.76	Higher	3.75	Lower	7.10	3.75
WETLAND CONDITION (EC)			5.65	Moderate		7.92
WETLAND RISK (average of Sensitivity & Stressors)			8.54	Higher		4.85

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	31.65209454	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	8.026091788	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	20.62781372	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	10.01403195	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	29.10168234	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-10-WM

Date: July 28, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.565000 -63.744843

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.12	Lower	5.08	Moderate	3.53	2.25
Stream Flow Support (SFS)	1.17	Lower	0.00	Lower	0.94	0.00
Water Cooling (WC)	5.25	Moderate	1.87	Lower	3.50	1.01
Sediment Retention & Stabilisation (SR)	3.77	Moderate	0.47	Lower	5.14	0.23
Phosphorus Retention (PR)	1.39	Lower	0.43	Lower	4.62	0.33
Nitrate Removal & Retention (NR)	3.95	Moderate	2.50	Lower	5.63	2.50
Carbon Sequestration (CS)	1.66	Lower			5.98	
Organic Nutrient Export (OE)	7.01	Moderate			4.58	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	6.16	Higher	3.61	Moderate	6.01	3.19
Amphibian & Turtle Habitat (AM)	4.52	Moderate	4.94	Moderate	5.49	5.83
Waterbird Feeding Habitat (WBF)	5.40	Moderate	6.67	Moderate	4.11	6.67
Waterbird Nesting Habitat (WBN)	3.89	Moderate	6.67	Higher	2.82	6.67
Songbird, Raptor, & Mammal Habitat (SBM)	7.72	Higher	6.67	Moderate	6.72	6.67
Pollinator Habitat (POL)	10.00	Higher	6.67	Moderate	8.54	6.67
Native Plant Habitat (PH)	4.88	Moderate	7.31	Moderate	5.85	7.31
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			9.88	Higher		4.99
Wetland Ecological Condition (EC)			7.68	Higher		8.89
Wetland Stressors (STR) (higher score means more stress)			4.64	Moderate		2.41
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.12	Lower	5.08	Moderate	3.53	2.25
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.32	Moderate	1.82	Lower	5.66	1.76
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	5.96	Higher	2.72	Lower	4.88	2.30
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	4.08	Moderate	5.16	Higher	3.99	5.25
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.77	Higher	7.09	Moderate	7.79	7.09
WETLAND CONDITION (EC)			7.68	Higher		8.89
WETLAND RISK (average of Sensitivity & Stressors)			7.26	Higher		3.70

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	10.76069186	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	6.030025021	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	16.20416672	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	21.05976071	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	62.18893978	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-11-WM

Date: July 26, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.566259 -63.739058

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	0.60	Lower	7.95	Higher	2.39	3.52
Stream Flow Support (SFS)	5.24	Higher	10.00	Higher	4.22	7.12
Water Cooling (WC)	6.75	Higher	8.07	Higher	4.50	4.37
Sediment Retention & Stabilisation (SR)	2.96	Lower	8.59	Higher	4.51	4.21
Phosphorus Retention (PR)	1.99	Lower	8.30	Higher	4.99	6.46
Nitrate Removal & Retention (NR)	2.40	Lower	10.00	Higher	4.51	10.00
Carbon Sequestration (CS)	4.69	Moderate			7.42	
Organic Nutrient Export (OE)	9.88	Higher			6.45	
Anadromous Fish Habitat (FA)	7.14	Higher	2.38	Moderate	4.68	1.51
Resident Fish Habitat (FR)	8.17	Higher	2.26	Moderate	4.44	1.41
Aquatic Invertebrate Habitat (INV)	6.94	Higher	7.68	Higher	6.32	5.38
Amphibian & Turtle Habitat (AM)	3.78	Moderate	4.82	Moderate	5.10	5.73
Waterbird Feeding Habitat (WBF)	6.62	Higher	5.00	Moderate	5.04	5.00
Waterbird Nesting Habitat (WBN)	8.10	Higher	5.00	Higher	5.87	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	8.22	Higher	10.00	Higher	7.16	10.00
Pollinator Habitat (POL)	6.76	Moderate	10.00	Higher	5.60	10.00
Native Plant Habitat (PH)	6.39	Higher	10.00	Higher	6.45	10.00
Public Use & Recognition (PU)			3.43	Moderate		2.65
Wetland Sensitivity (Sens)			7.80	Higher		4.39
Wetland Ecological Condition (EC)			4.78	Moderate		7.50
Wetland Stressors (STR) (higher score means more stress)			7.02	Higher		3.55
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	0.60	Lower	7.95	Higher	2.39	3.52
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.85	Moderate	9.48	Higher	6.39	8.44
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	8.54	Higher	9.29	Higher	5.91	6.37
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.47	Higher	4.45	Moderate	5.45	4.73
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.67	Higher	10.00	Higher	6.78	10.00
WETLAND CONDITION (EC)			4.78	Moderate		7.50
WETLAND RISK (average of Sensitivity & Stressors)			7.41	Higher		3.97

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	4.737834574	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	36.50888362	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	79.34048284	Moderate
HABITAT SUPERGROUP - AQUATIC HABITAT	33.18755583	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	76.73427801	Moderate

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-12-WM

Date: July 15, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.541444 -63.723408

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.43	Lower	6.77	Higher	3.02	3.00
Stream Flow Support (SFS)	2.69	Moderate	9.35	Higher	2.17	6.22
Water Cooling (WC)	7.55	Higher	9.27	Higher	5.03	5.02
Sediment Retention & Stabilisation (SR)	3.77	Moderate	8.98	Higher	5.14	4.40
Phosphorus Retention (PR)	0.59	Lower	8.30	Higher	4.12	6.46
Nitrate Removal & Retention (NR)	3.49	Moderate	10.00	Higher	5.29	10.00
Carbon Sequestration (CS)	1.12	Lower			5.72	
Organic Nutrient Export (OE)	8.06	Higher			5.27	
Anadromous Fish Habitat (FA)	9.76	Higher	2.68	Moderate	6.40	1.70
Resident Fish Habitat (FR)	6.95	Higher	2.56	Moderate	3.78	1.60
Aquatic Invertebrate Habitat (INV)	6.51	Higher	7.20	Higher	6.15	5.12
Amphibian & Turtle Habitat (AM)	4.28	Moderate	4.60	Moderate	5.37	5.55
Waterbird Feeding Habitat (WBF)	5.23	Moderate	5.00	Moderate	3.98	5.00
Waterbird Nesting Habitat (WBN)	4.85	Moderate	5.00	Higher	3.52	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	8.82	Higher	10.00	Higher	7.68	10.00
Pollinator Habitat (POL)	8.35	Higher	10.00	Higher	6.92	10.00
Native Plant Habitat (PH)	4.30	Moderate	10.00	Higher	5.62	10.00
Public Use & Recognition (PU)			3.52	Moderate		2.71
Wetland Sensitivity (Sens)			10.00	Higher		5.72
Wetland Ecological Condition (EC)			6.52	Higher		8.33
Wetland Stressors (STR) (higher score means more stress)			6.51	Higher		3.31
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.43	Lower	6.77	Higher	3.02	3.00
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.01	Moderate	9.55	Higher	5.40	8.48
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.13	Higher	8.98	Higher	5.40	5.84
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	7.99	Higher	4.48	Moderate	5.50	4.66
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.99	Higher	10.00	Higher	7.21	10.00
WETLAND CONDITION (EC)			6.52	Higher		8.33
WETLAND RISK (average of Sensitivity & Stressors)			8.26	Higher		4.52

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	9.704134823	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	28.7020466	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	64.02569924	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	35.81786912	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	79.90462138	Moderate

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-13-WM

Date: July 15, 2022

Observer: Chris Kennedy

Latitude & Longitude (decimal degrees): 45.560951 -63.754332

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	2.14	Lower	5.36	Moderate	3.54	2.38
Stream Flow Support (SFS)	1.01	Lower	0.00	Lower	0.81	0.00
Water Cooling (WC)	6.00	Higher	0.95	Lower	4.00	0.52
Sediment Retention & Stabilisation (SR)	1.70	Lower	7.66	Higher	3.52	3.75
Phosphorus Retention (PR)	0.99	Lower	7.29	Higher	4.37	5.67
Nitrate Removal & Retention (NR)	2.90	Moderate	10.00	Higher	4.87	10.00
Carbon Sequestration (CS)	1.72	Lower			6.01	
Organic Nutrient Export (OE)	7.25	Moderate			4.74	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	4.85	Moderate	3.09	Moderate	5.47	2.91
Amphibian & Turtle Habitat (AM)	3.89	Moderate	3.78	Moderate	5.16	4.88
Waterbird Feeding Habitat (WBF)	4.21	Moderate	5.00	Moderate	3.21	5.00
Waterbird Nesting Habitat (WBN)	3.66	Moderate	5.00	Higher	2.65	5.00
Songbird, Raptor, & Mammal Habitat (SBM)	7.38	Moderate	5.00	Moderate	6.42	5.00
Pollinator Habitat (POL)	8.03	Higher	0.00	Lower	6.65	0.00
Native Plant Habitat (PH)	4.34	Moderate	4.36	Lower	5.64	4.36
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			10.00	Higher		5.04
Wetland Ecological Condition (EC)			5.65	Moderate		7.92
Wetland Stressors (STR) (higher score means more stress)			4.96	Moderate		2.57
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	2.14	Lower	5.36	Moderate	3.54	2.38
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	2.37	Lower	9.16	Higher	5.35	8.24
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	6.01	Higher	2.22	Lower	4.61	2.02
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.28	Moderate	3.88	Moderate	3.68	3.99
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	7.31	Higher	4.06	Lower	6.45	4.06
WETLAND CONDITION (EC)			5.65	Moderate		7.92
WETLAND RISK (average of Sensitivity & Stressors)			7.48	Higher		3.81

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	11.44399803	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	21.67015009	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	13.32998268	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	12.73171116	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	29.66204504	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-14-WM

Date: July 14, 2022

Observer: Zacharye Simai

Latitude & Longitude (decimal degrees): 45.557509 -63.757191

Scores will appear below after data are entered in worksheets OF, F, and S.
See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	1.57	Lower	7.73	Higher	3.12	3.43
Stream Flow Support (SFS)	1.59	Moderate	7.92	Higher	1.28	5.27
Water Cooling (WC)	6.75	Higher	2.21	Moderate	4.50	1.20
Sediment Retention & Stabilisation (SR)	2.96	Lower	7.84	Higher	4.51	3.84
Phosphorus Retention (PR)	2.25	Lower	7.50	Higher	5.15	5.83
Nitrate Removal & Retention (NR)	2.61	Lower	10.00	Higher	4.66	10.00
Carbon Sequestration (CS)	3.86	Moderate			7.02	
Organic Nutrient Export (OE)	9.76	Higher			6.38	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	5.00	Moderate	3.43	Moderate	5.53	3.09
Amphibian & Turtle Habitat (AM)	3.78	Moderate	4.90	Moderate	5.11	5.80
Waterbird Feeding Habitat (WBF)	4.91	Moderate	6.67	Moderate	3.74	6.67
Waterbird Nesting Habitat (WBN)	3.77	Moderate	6.67	Higher	2.73	6.67
Songbird, Raptor, & Mammal Habitat (SBM)	8.02	Higher	6.67	Moderate	6.98	6.67
Pollinator Habitat (POL)	8.92	Higher	6.67	Moderate	7.39	6.67
Native Plant Habitat (PH)	5.79	Moderate	7.01	Moderate	6.21	7.01
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			5.69	Moderate		3.79
Wetland Ecological Condition (EC)			6.52	Higher		8.33
Wetland Stressors (STR) (higher score means more stress)			4.68	Moderate		2.43
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	1.57	Lower	7.73	Higher	3.12	3.43
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	3.39	Moderate	9.22	Higher	6.18	8.28
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	7.77	Higher	6.22	Moderate	5.40	4.23
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	3.70	Moderate	5.16	Higher	3.71	5.25
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	8.25	Higher	6.90	Moderate	7.13	6.90
WETLAND CONDITION (EC)			6.52	Higher		8.33
WETLAND RISK (average of Sensitivity & Stressors)			5.19	Moderate		3.11

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	12.12681411	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	31.25293294	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	48.32256508	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	19.09968079	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	56.90901529	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**

Assessment Area (AA) Results:

Wetland ID: WL-15-WM

Date: July 27, 2022

Observer: Chris Kennedy & Zacharye Simai

Latitude & Longitude (decimal degrees): 45.556029 -63.770262

Scores will appear below after data are entered in worksheets OF, F, and S. See Manual for definitions and descriptions of how scores were computed.

Wetland Functions or Other Attributes:	Function Score (Normalised)	Function Rating	Benefits Score (Normalised)	Benefits Rating	Function Score (raw)	Benefits Score (raw)
Water Storage & Delay (WS)	4.55	Moderate	6.54	Moderate	5.34	2.90
Stream Flow Support (SFS)	0.78	Lower	0.00	Lower	0.63	0.00
Water Cooling (WC)	3.75	Moderate	0.66	Lower	2.50	0.36
Sediment Retention & Stabilisation (SR)	4.00	Moderate	9.34	Higher	5.32	4.57
Phosphorus Retention (PR)	0.56	Lower	7.93	Higher	4.10	6.17
Nitrate Removal & Retention (NR)	3.15	Moderate	10.00	Higher	5.05	10.00
Carbon Sequestration (CS)	2.41	Lower			6.34	
Organic Nutrient Export (OE)	7.15	Moderate			4.67	
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower	0.00	0.00
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower	0.00	0.00
Aquatic Invertebrate Habitat (INV)	3.24	Lower	3.41	Moderate	4.82	3.08
Amphibian & Turtle Habitat (AM)	4.68	Moderate	2.84	Moderate	5.58	4.10
Waterbird Feeding Habitat (WBF)	4.48	Moderate	2.50	Lower	3.41	2.50
Waterbird Nesting Habitat (WBN)	4.29	Moderate	2.50	Moderate	3.11	2.50
Songbird, Raptor, & Mammal Habitat (SBM)	7.35	Moderate	2.50	Lower	6.39	2.50
Pollinator Habitat (POL)	8.81	Higher	0.00	Lower	7.30	0.00
Native Plant Habitat (PH)	3.24	Lower	4.56	Lower	5.19	4.56
Public Use & Recognition (PU)			1.82	Moderate		1.54
Wetland Sensitivity (Sens)			7.66	Higher		4.35
Wetland Ecological Condition (EC)			0.72	Lower		5.56
Wetland Stressors (STR) (higher score means more stress)			5.27	Moderate		2.72
Summary Ratings for Grouped Functions:						
HYDROLOGIC Group (WS)	4.55	Moderate	6.54	Moderate	5.34	2.90
WATER QUALITY SUPPORT Group (max+avg/2 of S	3.27	Moderate	9.54	Higher	5.77	8.46
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV,	5.44	Moderate	2.38	Lower	3.98	2.11
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM	3.68	Moderate	2.20	Moderate	4.00	2.96
TRANSITION HABITAT Group (max+avg/2 of SBM, P	7.64	Higher	3.46	Lower	6.80	3.46
WETLAND CONDITION (EC)			0.72	Lower		5.56
WETLAND RISK (average of Sensitivity & Stressors)			6.46	Moderate		3.53

NOVA SCOTIA - Functional WSS Interpretation Tool

1. General Description of Tool:

This interpretive tool automatically determines whether the subject wetland will be regulated as a Wetland of Special Significance (WSS). This determination is made based on the WESP-AC functional results, per the Nova Scotia *Wetland Conservation Policy* .

A 'Function-Benefit Product' (FBP) is calculated based upon the Grouped Functions, and has a theoretical maximum of 100. Threshold values for the FBP are applied, in order to categorize the FBP scores into 'Low', 'Moderate' or 'High' scores. Thresholds are determined based upon the statistical distribution of WESP-AC scores compiled from various sites across the Province (N=442). These categories are subsequently used to apply various 'Functional WSS Rules', as described below.

For the purpose of defining and applying the Functional WSS rules, two supergroups are defined based on grouped functions, as follows: **(1) Support Supergroup** - includes Hydrologic, Water Quality Support, and Aquatic Support grouped functions. **(2) Habitat Supergroup** - includes Aquatic Habitat and Transition Habitat grouped functions.

2. Functional WSS Rule Definitions:

Habitat Rule: In consideration of the Habitat Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(HAB 1) Two 'High Scores' OR

(HAB 2) One 'High' and one 'Moderate' score

Support Rule: In consideration of the Support Supergroup, the subject wetland is a WSS if either of the following sub-rules are satisfied:

(SUP 1) Three 'High' scores OR

(SUP 2) Two 'High' and one 'Moderate' score

Habitat/Support Hybrid Rule: In consideration of both the Habitat and Support Supergroups, the subject wetland is a WSS if the following is satisfied:

(HYB 1) One 'High' Habitat score **AND** Two or three 'High' Support scores

3. Functional WSS Interpretation Results

Function-Benefit Product (FBP)	FBP SCORE	FBP SCORE CATEGORY
SUPPORT SUPERGROUP - HYDROLOGIC	29.78846543	Low
SUPPORT SUPERGROUP - WATER QUALITY SUPPORT	31.18217254	Low
SUPPORT SUPERGROUP - AQUATIC SUPPORT	12.97683963	Low
HABITAT SUPERGROUP - AQUATIC HABITAT	8.12032065	Low
HABITAT SUPERGROUP - TRANSITION HABITAT	26.41523493	Low

3a. Functional WSS Determination: Automatic Method

Habitat Rule Satisfied?	NO
Support Rule Satisfied?	NO
Habitat/Support Hybrid Rule Satisfied?	NO
CONCLUSION:	**Site is not a WSS**