ONTARIO WETLAND EVALUATION SYSTEM

Northern Manual

2nd Edition

2022

Ontario

2nd Edition
December 2022

OWES Revision History:
1st Edition – March 1993
1st Edition, 1st revision – May 1994
1st Edition, 2nd revision – December 2002
1st Edition, 3rd revision – August 2014

Cette publication spécialisé n'est pas disponible qu'en anglais

50254
ISBN 978-1-4868-6689-2 PDF
ISSN 1192-8484

TABLE OF CONTENTS

Pitcher plant Photo: Rebecca Zeran

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION TO THE EVALUATION SYSTEM

Photo: MNR-2007 Canada-Ontario Agreement

As a steward of Ontario's natural resources, one of the Ontario Ministry of Natural Resources and Forestry's (MNRF) mandates is the protection and sustainable management of the province's natural heritage features, including wetlands. To aid in identifying those wetlands that have value at a provincial scale, MNR has developed this wetland evaluation system (referred to throughout the text as the "OWES", the "evaluation system", or "this manual").

Wetlands are land types that are commonly referred to as swamps, fens, mires, marshes, bogs, sloughs and peatlands. They occur intermittently across the landscape along lakes, rivers and streams, and in other areas where the water table is close to the surface. They vary in size from a fraction of a hectare to many thousands of hectares.

As areas where land and water come together, wetlands provide unique and specialized habitat for a great variety of species that can live nowhere else. If wetlands small and large cannot survive in reasonable abundance across the landscape, their dependent species will decrease in number and eventually disappear. The survival of wetlands helps to preserve ecological processes and functions that secure and protect the quality of the biosphere in which humans and other organisms together must dwell.

Although the evaluation system is based on scientific criteria, it was developed primarily to serve the needs of Ontario's planning process that is generally implemented by municipalities. The evaluation system recognizes the role that wetlands play in maintaining critical ecosystem functions, providing social benefits, moderating storm flows, improving water quality, and protecting rare species. The system provides a way of rating wetlands relative to each other and also provides information about why one wetland is more important than another. The evaluation system can also be used to carry out a preliminary or "first cut" biophysical inventory of a wetland.

This evaluation system and any updates or addendums issued are the only means of evaluating wetlands in Ontario to determine whether they are provincially significant. In the OWES, the term "significant wetland" refers to Provincially Significant Wetlands, or PSWs, as determined by the criteria outlined in this manual. Although other information sources, maps or inventory approaches (e.g., the Ecological Land Classification System) may be used to aid evaluators in undertaking a wetland evaluation, it is the OWES that determines whether a wetland is a PSW and, likewise, determines the boundaries of the PSW wetland.

The evaluation manual for northern wetlands was derived from the evaluation process that has been used in southern Ontario since the early 1980's (Environment Canada and Ministry of Natural Resources, 1984). This version of the manual is an update of the northern manual released in 2002. Most of the components of the two systems are the same but important differences do exist. These differences reflect true differences in condition between northern and southern Ontario and permit northern wetlands to be compared among themselves. Figure 1 shows the boundary for application of the two manuals.

Similarly, if a wetland is located on a border between Ecoregions 1 and 2 the local MNR District should be consulted to determine whether an OWES evaluation is appropriate.

Pressures on northern wetlands are, in many areas, quite different from pressures in southern Ontario. Although urban development (including recreational developments) and drainage for agriculture are a concern in the more southern, settled parts of the north, pressures from activities such as forestry, mining, hydro-electric development, and peat extraction are significantly different from those in southern Ontario.
In addition, many northern wetlands are found on Crown land, a situation very different from that in the south. Nevertheless, as a tool to be used primarily in the land use planning process, the evaluation system is likely to be applied most frequently in areas where wetlands are under development pressures. Such areas include, but are not limited to, most of Hills Site Region 5, the Greater Claybelt, the Lake Superior shoreline and the Lake of the Woods area.

Wetlands in northern Ontario are still abundant even in the more settled areas. This evaluation manual is designed to be applicable to all freshwater wetlands located within Ecoregions 2, 3, 4 and 5 as defined by Hills (1959, 1961) and modified by Crins *et al.*(2009).

Since this evaluation system is designed to identify and measure recognized values of wetlands, it should provide a mechanism or framework through which conflicting claims about wetland values and uses can be resolved. The application of this system provides knowledge of the different kinds of wetland functions, which is then available for examination and review by any interested person, agency or group.

The evaluation system does not evaluate vulnerability of wetlands to various sorts of developments and pressures. The system is a tool that allows consideration of the relative value of different wetlands through the examination and ranking of a number of wetland functions. The assessment of vulnerability is considered to be presumptive and outside the scope of this evaluation.

Likewise, the evaluation system does not suggest the kinds of management that would be best for a wetland. However, the information gathered through the application of this evaluation system can provide the basis for considering management options and alternatives.

The results of evaluations made under this system are primarily used by a municipality or county government as part of the municipal planning process where there is a need to know: (a) whether a specific wetland has been evaluated or not, to assist in determining if it should be evaluated, and (b) whether a wetland has been identified as a PSW.

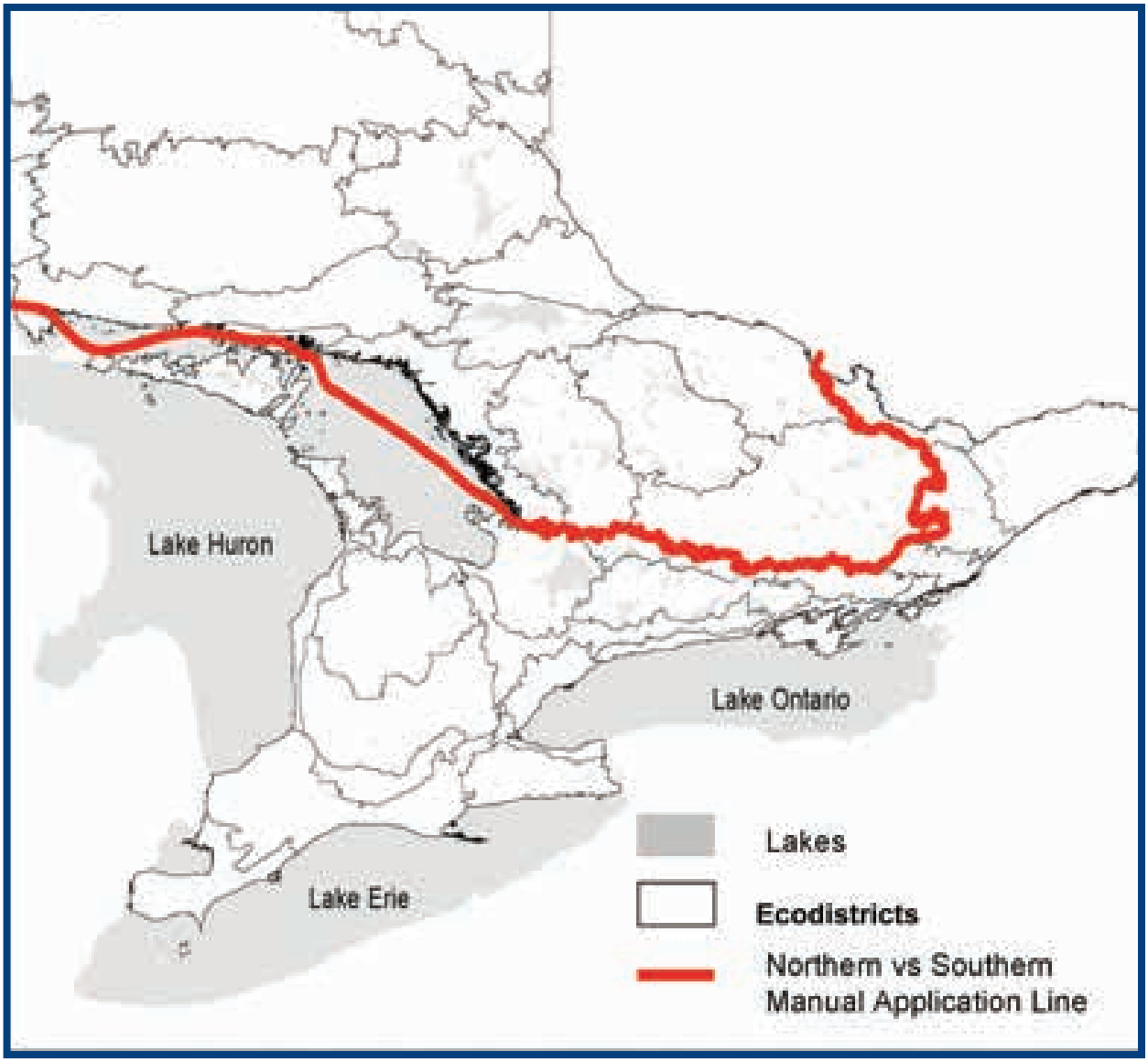


Figure 1: Boundary for application of Northern and Southern Wetland Evaluation Manuals in Ontario.
Note: for illustrative purposes only; evaluators should use the Ecodistrict layer available through Land Information Ontario.

RATIONALE FOR WETLAND FEATURES INCLUDED IN THE EVALUATION

A system of evaluation for wetlands must be concerned with the definition, identification and measurement of wetland **functions**. The wetland is then evaluated based upon the perceived values of characteristics, activities, or expressions of the wetland or its parts that function to maintain ecosystem processes, or that have some utility or amenity value to a segment of society. While these two kinds of values are perceived as being different, humans cannot separate their utility needs or desires from the orderly functioning of healthy ecosystems. Wetland values recognized in this evaluation system include both ecosystem and human utility values:

1. Ecosystem values. These include the many roles that wetlands play in the functioning of natural ecological processes. Such ecosystem values occur in the wetland itself, in the wetland's immediate vicinity, or downstream. They include specific characteristics such as primary production, watershed protection, preservation of biodiversity, maintenance of three dimensional vegetation systems necessary for much of animal life, the maintenance of conditions essential for symbioses, natural cycles (such as carbon, nitrogen, water), provision of species to support food chains, and similar characteristics that provide for higher (or more inclusive) levels of organization in the terrestrial and aquatic landscape. Ecosystem functions at higher levels are discussed by Rowe (1961, 1990a, p. 244); Odum (1971); de Groot (1986) and others.

2. Human utility values. These include the social and economic values that wetlands provide to people. Such values include the benefits provided by wetlands in flood attenuation, recreation, production of economically valuable products, improvement of water quality, educational benefits and the like.

Wetland values recognized in the evaluation system are many and varied with respect to their fundamental nature. Thus, the evaluation includes, among other things, values which derive from an expression, an activity, an amount, a distance, a timing, a direct benefit to humans, the presence of a species or ecological circumstance and the like. The rationale for inclusion of each value is provided so that the reasons for selecting and weighting the values in relation to others within the system are as clear as possible. The values defined are intended to be mutually exclusive, or nearly so.

The kinds of information to be gathered, or attributes to be measured, by this system were determined based on a number of considerations. These are:

1. The needed information could be secured without having to engage in time-consuming scientific research;

2. Needed information could be obtained after a training period by individuals already having the required expertise in wetland ecology, flora and fauna;

3. Information related to each wetland value could be meaningfully graded into a scale of numbers ranging from little or no value to "full value";

4. Consultation with many professionals in the fields of biology, ecology, hydrology and agriculture eliminated controversial values.

5. The ability to "leverage" information from a variety of available sources (e.g., natural heritage inventories) which can reduce the amount of field work required to complete a wetland evaluation.

The evaluation system considers only the positive values of wetlands. Hence, it will be the presence of positive values that will determine which wetlands have more value than others.

EXPERTISE REQUIRED TO APPLY THIS EVALUATION SYSTEM

Photo: Anne Yagi

OWES must be carried out only by persons who have been approved by the Ministry of Natural Resources as having the necessary qualifications including the following **minimum** expertise:

1. Adequate knowledge and experience with wetland ecology to be able to identify correctly all wetland types, their characteristic species and features.

2. Adequate knowledge of flora/fauna to the extent of being able to identify most wetland species, species of immediately adjacent upland areas and significant or rare species. Associated skills in the use taxonomic keys are also necessary.

3. Sufficient knowledge of aerial/satellite photography, orthophoto interpretation, and/or other remotely-sensed information to interpret wetland area, wetland vegetation and wetland boundaries;

4. General knowledge of natural history, wildlife, and soils (substrates).

5. Some understanding of hydrological processes.

Persons will be required by the Ministry to take an MNR-approved wetland evaluation course to gain the necessary recognition as a wetland evaluator in Ontario.

While it is desirable for evaluators to be able to identify rare species (particularly plant species) that may be present in a wetland, it is recognized that an adequate evaluation can be conducted by evaluators with moderate plant identification skills. It is recommended that an inventory of rare species, separate from the evaluation, be conducted by an appropriate technical expert where the evaluator does not have the necessary knowledge to identify rare species, and/or where rare species are suspected to be present on the site.

HOW THE SCORING SYSTEM WORKS

In this evaluation, wetland values are grouped into four principal components. These are **Biological, Social, Hydrological,** and **Special Features**. Each component is evaluated individually and separately from the others. Each component is further subdivided into subcomponents, and some subcomponents are further subdivided into attributes and some into subattributes.

The method used for assessing the value of a component, subcomponent, attribute or subattribute is numerical. Thus, relative value is assessed by ascribing point totals to predefined values. The scores are then totalled to

provide a measure of value at the subcomponent and component levels. The total number of points for each of the four major components is capped at 250 points. A wetland can score a maximum of 1000 points.

The values that are assessed and the scores assigned derive from the judgement of a large number of people with many years of experience in wetland science and evaluation. This system parallels the evaluation system for southern Ontario which was developed in the early 1980's (Environment Canada and Ministry of Natural Resources 1984). At that time a Canada/Ontario Steering Committee on Wetland Evaluation (which included both government and non-government experts) carried out numerous reviews of and adjustments to scores, and made final decisions on weighting. Experience in use of the 1984 edition resulted in suggestions for improvements to the scoring for the southern system. Many of these were implemented by the Southern Ontario Wetland Evaluation Review Committee for the southern system and were carried over into the northern system by the Northern Wetlands Working Group and the Provincial Wetland Working Group. Thus, experience and calculated judgement of dozens of people about the **relative importance** of the accepted variables is the basis for the credibility of the scores. The validity of the system as a whole stems from the long process carried out with deliberation and attention to detail over many years.

Within each component, subcomponent, attribute and/or sub-attribute, values have been weighted to reflect their importance relative to each other.

This manual sets out guidance for assessing wetlands. Evaluators should rely on their observation, data collection and research and use their professional judgement and expertise in applying the OWES.

WETLAND RE-EVALUATIONS AND MAPPING UPDATES

A wetland that has already been evaluated may be re-evaluated or an evaluated wetland boundary can be updated. A "wetland re-evaluation" means that a new wetland evaluation is undertaken in accordance with OWES, including field assessment, scoring and boundary delineation (mapping). A "mapping update" means that the outer boundary of an evaluated wetland is updated to reflect new information or changes on the land.

The following must be considered when undertaking a wetland re-evaluation or a mapping update:

- Re-evaluation of wetlands: Wetlands will retain their current status (i.e., significant or not) until such a time as a re-evaluation occurs.
- Re-evaluation of previously evaluated wetland complexes: With the exception of closely grouped wetlands, single wetland units that are part of a previously evaluated wetland complex can be re-evaluated (re-scored and re-mapped) without requiring a complete re-evaluation of all units in the existing wetland complex. Each previously evaluated wetland unit will retain its current status (e.g., significant or not) until such a time as the individual unit may be re-evaluated. All wetland units that were previously evaluated as part of a wetland complex do not need to be re-evaluated at the same time. There is no requirement to update the wetland evaluation that applied to an entire wetland complex. The evaluation is considered a point-in-time document used to assign a status (significant or not) to each wetland that the evaluation covered (i.e., all wetland units that had previously been complexed together). Previous wetland evaluation documentation can be used as a source of information when re-evaluating a formerly complexed wetland unit.

- Mapping updates to previously evaluated wetlands: Wetlands are dynamic natural systems and the outer boundary of a wetland can be updated if new information becomes available or if the extent of the wetland on the land changes. A mapping update can be undertaken without undertaking a re-evaluation. Evaluations are point-in-time assessments to determine a wetland's status (significant or not) and are not to be 'updated'.

A COMPLETE EVALUATION

A wetland evaluation, re-evaluation or mapping update will be considered complete and final once a trained wetland evaluator attests that they have undertaken an evaluation in accordance with OWES.

Once an evaluation, re-evaluation or mapping update is complete, the evaluator must:

- Send the final evaluation (including associated wetland boundary mapping) to the appropriate planning authority (e.g., municipality, Niagara Escarpment Commission); in areas of the province without municipal organization, forward the final evaluation to the MNRF for record keeping purposes.
- Notify any affected landowners of the property or properties containing the wetland of the final wetland boundary and wetland status;
- Evaluators must also forward a copy of the final digital wetland boundary mapping and the wetland's status (e.g., significant or not) to the MNRF within 30 days to be uploaded to Land Information Ontario (LIO).

SOURCES OF INFORMATION

The initial information gathering phase of the wetland evaluation process should involve personal contacts and studies of literature and information from as many sources as possible. Much of the information required in the WEDSR, such as location, land ownership, research and reports, etc. should be compiled and reviewed prior to field work. This element of the work is very important and adequate time should be allotted for its completion.

The Wetland Evaluation Data and Scoring Record (WEDSR) must be completed with a combination of field investigations and thorough search for existing information and uses. **WEDSRs should not contain blanks.** Rather, "no information available" should be clearly stated.

It is important to conduct as much of the background information search as possible prior to the field investigation. By doing so, the evaluator will have a solid basis upon which to plan and carry out the field work.

Other agencies, organizations, programs or initiatives that may have useful biological or general wetlands information include, but are not limited to:

- Federal, provincial and municipal governments, conservation authorities
- Indigenous communities
- Non-government environmental organizations
- Local residents, hunters, trappers and fishermen may be able to provide information on various wildlife species and on recreational uses of the wetland
- Inventory and monitoring programs (e.g., Marsh Monitoring Program)

It is absolutely essential to provide accurate and complete references to sources of information. Personal communications should be properly documented in the WEDSR with date, name and title of the person providing the information cited in the data records.

It is often advantageous to determine from government personnel, landowners or others familiar with the wetland the most efficient way to travel to and access the wetland.

LANDOWNER NOTIFICATION AND PERMISSION

Evaluators must notify landowners that a wetland evaluation is being undertaken for a wetland located on their property.

Landowner permission must be obtained before accessing private property to carry out wetland evaluation field work. Arrangements with landowners for access to private property must occur prior to the field work.

WETLAND SIZE

In general, wetlands smaller than 2 ha (5 acres) are not evaluated. However very small wetlands can provide habitat for wildlife or serve other ecological, hydrological, hydrogeological or social functions. A wetland smaller than 2 ha can be evaluated (and undergo a full wetland evaluation) provided that the rationale for doing so it included in the Wetland Evaluation Data and Scoring Record (WEDSR).

FRACTIONAL AREAS AND ROUNDING RULES

Any score or fractional area recorded throughout the manual must adhere to the rounding rules described below regardless of the tool – i.e., calculator, spreadsheet or database – being used to record and/or calculate scores.

Fractional Areas

Fractional Areas (FA) are to be entered into the data record to two decimal places only. The standard rounding rules (see below) apply.

For any particular wetland feature involving FAs, the total for all FAs must add up to 1. In some cases, the total of the individual FAs will not add up to 1. If this happens, the evaluator should adjust the numbers so that the FA does add to 1. The standard rule is to subtract or add to the largest FA.

For example:

Bog FA	=	0.11
Fen FA	=	0.03
Swamp FA	=	0.73
Marsh FA	=	0.15
Total FA	=	1.02

Using the standard FA adjustment rule, we would subtract 0.02 from the Swamp FA, resulting in a total FA of 1.

SUB COMPONENT (E.G., 1.1) AND SUB SUB COMPONENT SCORES (E.G., 1.1.2)

Only whole numbers are to be entered or recoded in the data records for Component scores, sub component scores or sub sub component scores. There are to be no decimal places in the Scoring Record.

When dealing with FAs in sub component or sub sub component score, rounding is only to be undertaken after adding up all the numbers that result in the total sub- or sub sub- component score. For example, each calculated FA should be rounded to 2 decimal places, added up and the result rounded to a whole number.

Example: 1.1.2 Wetland Type

	FA		Score
Bog	0.11	x3	0.33
Fen	0.03	x6	0.18
Swamp	0.71	x8	5.68
Marsh	0.15	x15	2.25

Total = 8.44, which is rounded to 8 for insertion into the sub sub component slot in the Scoring Record.

ROUNDING RULES

- Last digit is < 5: round down (e.g., 0.233 rounds to 0.23)
- Last digit is > 5: round up (e.g., 0.238 rounds to 0.24)
- Last digit = 5: consider the number before the 5 and apply the “even up, odd down” rule (e.g., 4.5 rounds to 5; 7.5 rounds to 7; 0.245 rounds to 0.25)

Photo: Rebecca Zeran

DEFINITION OF WETLANDS AND WETLAND AREAS

Photo: Donald Kirk

In this evaluation system wetlands are defined as:

> *"Lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants".*

The term wetland is a general one and includes specific land types commonly called marshes, bogs, swamps and fens. Other terms sometimes used to describe wetlands include: mires, sloughs and peatlands. Wetlands may be relatively simple or highly complex and diverse biologically and ecologically. Within a single wetland area (i.e. contiguous wetland) one may find very different ecological circumstances as for example, an open water marsh, a spring fed swamp forest, a floating lakeside fen, an open channel of river, and the open water edge of a lake. Despite these profound ecological differences, **the entire area is considered as a single wetland**. It is to be identified and evaluated as a single unit. Areas of upland where typical upland species are dominant are not to be included in the wetland area.

In this evaluation system, "hydric soils" refers to substrates classified as hydric (e.g., substrates of Moisture Regime 6 or greater) and '*nearly hydric*' (e.g., Moisture Regime 5 substrates which can be present in moist conditions), as determined by the latest Ecological Land Classification standards and classes (OMNR (2009). Additional information on hydric substrates can be found under substrates (see Wetland Boundaries) on page 17.

Wetlands constructed for purposes other than wetland conservation (e.g., storm water management ponds, sewage lagoons, water treatment ponds) and in active use as such are **not** considered under OWES.

Agricultural Lands: It should be clearly understood that if an area no longer meets the definition of a wetland, in terms of water, soil/substrate, and vegetation characteristics, then it should not be considered to be a wetland. Conversely, land which is under agricultural use, but which has retained all three characteristics of a wetland (e.g., related to water, soil/substrate and vegetation), is still considered to be one. Cattle pasturing or grazing, e.g., in a wooded swamp, is an example of an existing agricultural use that, while it may result in some degradation in the quality of the wetland, will usually allow the wetland to persist over time. In contrast, planting of crops or tillage should no longer be considered as wetland. See Wetland Boundaries for more information on wetland boundaries in agricultural areas.

FIELD VISITS

Wetland evaluations require one or more field visits to the wetland being evaluated, at an appropriate time of the year. To obtain a more accurate picture of the wetland and its functions, several field visits to the wetlands may be made at different times of the year.

Although site visits are an important part of any wetland evaluation, it is not expected that a wetland evaluator will traverse the entire wetland. Existing information prepared from earlier field visits allow the evaluator to utilize information collected about the site by others. Existing information such as documented species observations, mapping and aerial photography allow the evaluator to understand the general characteristics of the wetland. Site visits allow the evaluator to verify whether existing (general or specific) information is accurate and to record new field observations.

While only a trained wetland evaluator can undertake an evaluation, it is recognized that trained evaluators may make use of other persons who may have specialized skills that can aid an evaluator. This can include having persons not trained in OWES helping an evaluator undertake field visits. The evaluator must ensure that they review the work of any untrained field assistants to ensure the criteria set out in these manuals is appropriately considered.

TIMING OF FIELD VISITS

The timing of visits to each wetland will depend upon the season, type, size and complexity of the wetland and the amount of information that is already available. If the wetland contains permanent open water, then one or more visits will be essential during the summer or early fall to obtain data on the extent and nature of submergent and floating vegetation as well as on the hydrological characteristics. If spring ("leaf-off") air photos (infrared, orthophotos, B&W aerial) are available, then the extent of the wetland boundaries can be more accurately drawn compared to summer ("leaf-on") imagery. A spring field visit, or at least an interpretation of spring imagery should be undertaken in order to develop a better understanding of the extent of seasonal flooding and the maximum extent of the wetland. Palustrine wetlands (see section 1.1.3) should be visited during the low water stage to determine direction and nature (permanent and intermittent) of surface inflow and outflow. Large wetlands may require several visits to ensure that adequate information is obtained.

The characteristics of a wetland at any particular time of year are often governed by seasonal rainfall. Some wetlands are so complex that the evaluation team will need to exercise considerable judgement in determining the timing and the date(s) of field visits. The aim in all cases is to ensure that the WEDSR is as accurate, objective and complete as possible so that the conclusions drawn in the evaluation will stand up to independent verification.

PREPARATION FOR SITE VISITS

A dragonfly exuvia Photo: Rebecca Zeran

Site visits to wetlands, especially in remote areas, are potentially hazardous. Needless risk during field work should always be avoided and adequate safety precautions during field work are essential. In cases where hazards (especially in mires and/or geographically isolated wetlands) exist, evaluators should field-truth the wetland in groups of two or three.

Site visits allow evaluators to:

1. Determine wetland boundaries;
2. Delimit boundaries between wetland types;
3. Delimit vegetation communities;
4. Ascertain directions and period of drainage;
5. Check quality and authenticity of existing information;
6. Make observations of features and functions scored in the WEDSR (rare species, recreational use of wetland, economically valuable products, fish habitat)
7. Note weather conditions for the day and season;
8. Check soil/substrate types; and
9. Search for seeps and marl deposits.

There are a range of constraints that impact the number and type of field visits that take place for a wetland, including permissions from private landowners, condition of the site, seasonal and time constraints, the completeness of available background information, and an evaluator's expertise in aerial/satellite photo interpretation. Types of site visits include: unencumbered access through all or portions of the wetland, access via rights of way (e.g., roads, unopened municipal road allowances, hydro corridors), road side checks, water access, using binoculars in leaf-off conditions to examine the interior of a site, flying over the site, and other means of making direct observations. The completeness of existing background information and an understanding of what field observations must be and/or can be made are factors to be taken into account when planning for a site visit or visits.

A list of field guides and manuals that each evaluation team might find useful is presented in Appendix 3.

FEATURES TO MAKE NOTE OF IN THE FIELD

Evaluators should have a good understanding of the differences between swamp, marsh, bog and fen wetland types before conducting the field portion of the wetland evaluation. They should be able to identify the vegetation communities and common plant species commonly found in each of these wetland types.

Information should be recorded on field data sheets, on the field map, and on the data summary sheets (use of a GPS unit and camera is also recommended).

Evaluators should make note of the following features when in the field:

- Active beaver lodges/dams
- Locations of rare species (note habitat, abundance, behaviour, etc.)
- Wildlife observations (e.g., furbearers, waterfowl, baitfish, bullfrogs, snapping turtles)
- Plant species observations (e.g., wild rice, cranberries)
- Location, nature, and directions of water flow at all inflowing and out-flowing rivulets, streams or ditches, etc.
- Human-related 'disturbances' (e.g., fill, docks, houses, cattle grazing, etc.)
- Evidence of recreational activities (e.g., nature appreciation, hunting, fishing)
- Locations of seeps or springs
- Presence of laggs
- Iron precipitates, marl deposits
- Winter cover for wildlife
- Ungulate summer habitat, moose aquatic feeding habitat
- Suitability of wetland for waterfowl breeding, presence of waterfowl breeding, waterfowl staging, and waterfowl moulting
- Surrounding topography (e.g., flat, rolling, hilly, steep)
- Surrounding habitat diversity
- Soils/substrates for each vegetation community
- Vegetation community forms (dominant and others)
- Wetland and site type
- Per cent open water (see section 1.2.6 – 'Open Water Types' for more information)
- Fish habitat (low or high marsh, seasonal or permanent swamp, fish or habitat observed)
- Observations/locations of invasive species
- Weather condition during evaluation

NOTE: Field observations are only required for fish habitat assessment when there is insufficient existing information to assign a score of locally, regionally, or provincially significant (see section 4.2.7). When this is the case, the one most dominant vegetation species of the dominant form must be recorded for each marsh community. Also note whether the community is to be considered as low marsh or high marsh, or seasonally or permanently flooded swamp fish habitat.

PERCENTAGE OF OPEN WATER

Two kinds of open water may be present within the wetland: seasonal open water and permanent open water. Permanent open water is an area that normally contains water throughout most of the year. Seasonal open water is an area that may contain water periodically (e.g., spring or fall snowmelt/rainfall inundations) and is normally dry for parts of the year.

The percentage of **permanent** open water should be assessed for each vegetation community during the field mapping of the wetland. Open water will be present in open water marshes, in swamps containing standing water and in marshes dominated by emergents but it is only the open water between the vegetation that is suitable for waterfowl, fish, and other species.

The percent open water should be estimated for each community where such water is present. Experience has shown that percent of open water is difficult to estimate accurately. Determining the percent open water from aerial photographs is relatively straight forward for marsh communities. Depending on the type of aerial photograph available, calculating the percentage of open water in swamps may not be feasible. In many swamps, standing open water pools or ponds under a deciduous tree canopy are not visible on aerial photographs. In such cases, the percent of open water should be confirmed as part of the field work. Aerial photography and most ortho-rectified photography is spring or fall, leaf-off imagery. As a result the maximum extent of open water in swamps during the spring generally can be estimated." As a result the maximum extent of open water in swamps during the spring generally can be estimated. These maximum levels can vary from year to year depending on snowfall and spring rainfall levels. One can also use the height of moss layers and ring marks on trees and shrubs to estimate the maximum extent of spring water levels in swamps.

In a large community, it can be difficult to assess open water from one location. In addition, variability caused by recent rains, drought, time of the season, and other factors can influence the estimate. To improve accuracy, the evaluator(s) should make a high and low estimate for each community. The final estimate will be the average of the two estimates. For example, if, in one community, the low estimate was 40% and the high was 60%, the average for that community would be 50%. Please see Table 3 in section 1.2.6 for an example of the recording and calculation for determining percent open water for the entire wetland.

NOTE: a community with open water does not necessarily equate to a wetland type of 'shallow open water marsh' or to 'open water (non-wetland)'. In this evaluation system, percentage open water for scoring purposes in section 1.2.6 is not influenced by wetland type as determined in section 1.1.2 (e.g., swamps, marshes, and even some fens may have areas of open water).

Photo: Rebecca Zeran

WETLAND BOUNDARIES

One of the most important evaluation tasks is the accurate identification and delineation of wetland boundaries. Evaluators must develop a full understanding of both the criteria for distinguishing wetlands from non-wetlands and also the methods of mapping and measurement. Wetland boundaries are not always obvious. Evaluators must be willing to invest the time needed to satisfy themselves that boundaries have been accurately located and mapped.

The outer boundary of a wetland (which determines its size) is the one which will be used in several key aspects of the evaluation. However, several internal boundary lines must also be drawn. Internal boundaries are those between the four wetland types (see Section 1.1.2) and between vegetation communities (see Section 1.2.2). Criteria for establishing internal boundaries are explained in these sections of the Biological Component.

Identification and delineation of outer wetland boundaries is based, first and foremost, on the presence and relative abundance of wetland plant species. It is important that evaluators be able distinguish wetland from upland plant species.

In many cases the outer boundary of a wetland can be clearly delineated by using plant species. However, wetland boundaries that occur in zones of gradual ecological change (ecotones) can sometimes seem indefinite. In such cases, other criteria such as substrates may help evaluators identify wetland boundaries. The nature of the underlying substrate can provide important information to help evaluators determine wetland boundaries.

In addition, elevation mapping can be used to further inform the decision as to whether site characteristics indicate a wetland or non-wetland area.

Additional guidelines for delineating wetland boundaries in specific transition areas are also provided below, including: 1) wetlands bordering upland forest, 2) wetlands bordering lakes and rivers, 3) wetlands bordering agricultural fields, pasture or urban areas, 4) seasonally flooded lands, and 5) beaver-flooded areas.

VEGETATION

The composition of the plant community has long been used as the primary criterion to determine if wetland habitat is present. The plant species composition in a given area represents the integrated response of that area to complex and interacting environmental factors – also known as the "biological response variable". Once a certain threshold of "soil moisture saturation" is surpassed, the plant composition shifts to those species adapted and able to thrive in wet environments.

Knowing which plant species are characteristic of wetland areas is necessary for delineating wetland boundaries. The assessment of the relative abundances of wetland versus terrestrial plant species is a primary task of the evaluator and is known as the "**50% wetland vegetation rule**". To assess the "50% wetland vegetation rule", the evaluator must: 1) identify wetland and upland plant species, and 2) estimate the relative abundance, or "cover", of wetland and upland species. When applying the 50% rule evaluators should refer to Appendix 10 and to the section on Timing of Field Visits for guidance on appropriate times for data collection.

Cover

Light and space are important parameters in assessing the relative importance of species, layers or growth forms. A simple yet effective way to assess these is to look at 'cover', which estimates the space occupied or shaded.

'Cover' is the area of ground covered or the relative proportion of coverage a particular plant species, vegetation layer or plant form represents. Cover can be expressed in relative or absolute terms (Lee *et al.* 1998).

Absolute Cover

The proportion of the ground area, expressed as a per cent, shaded by a particular plant species, vegetation layer or plant form; e.g. "shrub cover > 25%" means greater than 25% of the ground surface has shrub cover. Absolute cover is assessed by estimating the area on the ground covered by the shadow created by the vertical projection of the vegetation canopy.

Relative Cover

The proportion of the total cover, that a particular species, vegetation layer or plant form, represents; e.g., "coniferous species > 75% of canopy cover" means coniferous species make up greater than 75% of the canopy (coniferous forest) but do not necessarily cover at least 75% of the total ground area.

When identifying and delineating wetland boundaries, the "50% wetland vegetation" rule is used. This rule uses **relative cover**, and assesses the relative abundance of wetland plant species to upland plant species cover.

Assessing the "50% Wetland Vegetation" Rule

The intent of the "50% wetland vegetation" rule is to judge where plant species cover consists mostly of wetland plants. This is based on the inference that where wetland species make up most of the cover in an area, the area must contain wetter substrates and thus indicate wetland conditions.

The order in which the vegetation should be assessed, using the "50% wetland vegetation" rule, should follow the structural nature of the vegetation, from the upper layers to the ground and aquatic layers. The upper layers, especially the woody trees and shrubs, are typically longer lived and better reflect the long-term conditions of the site. In treed conditions, first assess whether the trees are wetland species, along with their relative cover. Similarly, in shrub dominated areas, begin with assessing the upper shrub layers first. Once woody vegetation has been assessed, or where only herbaceous vegetation dominates, move to the herbaceous, ground and aquatic layers. When there are contradictory messages from different layers, use the dominant layers as your primary indicator. For example, sometimes in altered wetlands, the trees will indicate wetland conditions yet the ground layers may not. In this case, the tree layers will take precedence over the ground layer., Other wetland criteria (e.g. soils) can also aid in the determination.

Some tree species that can dominate or co-dominate in swamps (e.g., the eastern white cedar, white elm, eastern hemlock, red maple, trembling aspen and balsam poplar) occur in both wetland and upland habitats. When these species dominate an area, one should also look at the understory layers and the substrate to help in determining whether you are in an upland or wetland. For example, if an area dominated by eastern white cedar occurs on hydric or near hydric substrates and is associated with a dominant groundcover or shrub layer of wetland plant species, it is an "eastern white cedar swamp", whereas, if the substrates are not hydric and the understory is dominated by upland plant species, then it is an "eastern white cedar upland forest".

"Wetland plant species" range from those species that occur primarily in wetlands ("wetland indicators") to those species that occur in both wetlands and uplands.

For delineating and mapping wetland boundaries, the "50% wetland vegetation" rule is used to locate a "contour line" that follows a series of points where relative plant species cover consists mostly of wetland species. Other factors, like substrates, are associated with the vegetation patterns, and can aid evaluators in the delineation. Evaluators may find it useful to create a contour line by sampling transects that traverse from upland to wetland conditions along the moisture gradient that encircles the wetland. The number of transects will depend on the size of the wetland and the complexity of the moisture gradient. Find the point along the transect(s) where the "50% vegetation rule" (and other wetland criteria) indicates wetland conditions. Delineate or draw the wetland boundary by connecting the points on adjacent transects, using observations of vegetation patterning and composition to shape the lines connecting each sample transect point.

It is very important to note that the "50% wetland vegetation" rule is not based on the number of species, but on the relative cover of species. For example, a list of species present at a site could lead to an incorrect conclusion. If there are more upland species than wetland species but the wetland plants dominate the site in terms of cover then the area is identified as wetland. Always the relative cover of species is assessed and not the number of wetland species versus the number of upland species.

SUBSTRATE

Substrates/soils can only be used to help determine whether an area is a wetland or not if the substrate information has been collected in the field.

Advances in soil science and better understanding of persistent features in substrates have made it possible to identify and describe "hydric" substrates. Hydric substrates have been defined by observing the association between hydrophytic vegetation and the substrates that support such wetland communities (Richardson and Vepraskas, 2001).

The primary features used to identify hydric substrates are the colours found within very moist, saturated and wet substrates, the depth at which they occur, and the type, pattern, and total amount of organic material. Specific colours found within wetland substrates reflect the duration and extent of saturation: "mottles" reflect an alternation between water saturation and drying (reduction to oxidation), whereas "gley" reflect more permanently saturated and reduced conditions. Extended saturation of substrates leads to anaerobic (i.e. loss of oxygen) conditions, affecting plant establishment and growth, and is the primary factor influencing plant distribution and selecting for hydrophytic species.

The Ontario Ecological Land Classification (ELC) program has established a provincial classification of substrates. As part of this classification, hydric substrates have been identified and named. Evaluators that have been trained in using ELC may find it useful to describe and record substrate features, along with moisture regime and the substrate material, using the latest ELC substrate standards and classes (OMNR 2009).

It is important to note here that the association between wetland vegetation and hydric substrates may not always be one-to-one, but may be complicated by many different factors. Some wetland habitats exhibit hydric substrates but no hydrophytic vegetation, specifically unvegetated communities surrounded by vegetated wetland communities (see Section 1.2.2). However, an area of hydric substrates that has been drained and largely supports upland species (i.e., with less than 50% relative cover of wetland species) would not be a wetland under the OWES definition.

The following moisture regime (MR) classes can be used to characterize the seasonal moisture budget of rock, mineral and organic substrates (Ontario Institute of Pedology 2003, Harris *et al.* 1996).

Moisture Class	Moisture Code	Description
Dry	D	Moisture regime is Θ or 0
Fresh	F	Moisture regime 1, 2 or 3
Moist	M	Moisture regime 4 or 5
Very Moist	V	Moisture regime 6
Wet	W	Moisture regime 7, 8 or 9
Saturated	S	Pore spaces filled (i.e., tidal flats)

See Appendix 9 for a summary of information on substrate types and characteristics.

SOIL MAPS

Use of soils and surficial geology parent material maps can contribute to the mapping of wetland boundaries. While the former generally models those soils close to the surface, the latter describes material up to one meter in depth. A soil that is formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part is referred to as a hydric soil and as such can support wetland vegetation. Both mapping sources have attributes that indicate soil permeability and drainage and can therefore be used to determine whether or not an area's soils are hydric. While presence of organic materials (peat) is an obvious indication of wetland - clay, silt and sand can also exhibit characteristics of hydric soils. For this reason it's extremely important to consider topographic position when interpreting mapped soil conditions. For example, sandy soil on top of a ridge rarely yields wetland conditions while riverine wetlands often have sandy but hydric soil. Such an interpretive approach will significantly improve a wetland evaluator's understanding of an area's ability to support wetland vegetation. It is best to obtain soils information for each vegetation community while in the field.

The activities of humans may have had profound impacts resulting in reduced, altered, or expanded wetland areas through drainage, clearing, dredging, dams, cultivation, and other activities. Soils maps may fairly accurately suggest the upland boundaries of only those wetlands that have not been drained or converted to other human uses and where the "original" hydrological regime remains more or less intact.

Boundaries on soils and surficial geology parent material maps are the result of a great degree of interpretation and therefore referred to as "fuzzy". Furthermore, all surficial geology maps and most soils maps generated for Ontario were captured at scales too imprecise (small) for site level planning. For these reasons this mapping has very limited value in establishing precise wetland boundary lines and should only be used as a general guide to their location. In no case should one consider the boundaries as indicated on soils maps to be definitive.

Rust-coloured mottles in a soil core Photo: Rebecca Zeran

ELEVATION MAPPING

Surface topography mapping, due to its strong correlation to both surface and ground water hydrology, is an indicator of the location of peat, hydric soils and wetland vegetation. It therefore may be useful to incorporate elevation information into the external wetland boundary delineation process. The OMNR maintains two main sources of digital elevation data useful for wetland interpretation. These include: contours and Digital Elevation Models (DEMs).

Contour information is available on all OBM mapping and is most useful in physiographic areas of Ontario with relatively significant relief. For example, areas like Algonquin Park have changes in elevation greater than the OBM contour interval (i.e. 5 meters) over a short horizontal distance. Consequently, wetland boundaries are well defined by the contour information. Evaluators should be aware however, that while most wetlands occur in low-lying areas, some seepage-fed wetlands are found on slopes, even steep ones. In some areas wetland boundaries are more closely associated more with the limits of groundwater exposure (as evidenced by hydric soils and wetland vegetation) than with ground surface topography. In contrast, areas such as southwestern Ontario are very flat and thus have large horizontal distances between contours. In cases such as this, where there is often a 100-meter distance or greater between contours, another elevation data source should be consulted.

DEM's are elevation images built with a number of different data sources and are generally far more useful than contours. Information such as contours, spot heights, rivers and lakes are always included in the DEM creation process. In many parts of the province DEM creation also includes a dense fabric of regularly spaced air photo interpreted elevation points. DEM's created with these data are significantly more useful for wetland boundary delineation. Although DEM images themselves can be used to interpret wetland boundaries, DEM derivatives are generally more useful for this purpose.

DEM derivatives are images that are created using DEM's. Two very useful DEM derivatives are slope and analytical hillshade. A slope image is created by calculating the rate of change in elevation for all locations on a DEM. Such an image highlights flat and steep areas. An analytical hillshade is created by simulating a light source (i.e. sun) from a specified angle and height. Hill slopes that face the source are bright while those that do not are shadowed (dark). In this way an analytical hillshade highlights surface relief and texture and is therefore very useful for wetland mapping. DEM's can also be used to create complex surface and groundwater derivatives, however, such derivatives are not as useful due to their complexity and accompanying interpretation difficulty.

Traditional stereo air photo interpretation, while time-consuming, allows for acquisition of the most wetland specific topographic information.

ADDITIONAL GUIDELINES FOR MAPPING TRANSITIONAL AREAS

WETLANDS BORDERING ON UPLAND FOREST

A large number of Ontario wetlands have a forested swamp at their edge which grades rapidly or very gradually into upland forest. As noted above, the principal criterion for determining the boundary of such wetland areas *will be the species composition of the plant community.* In general the wetland-upland boundary should be determined by the "50% wetland vegetation rule".

Some plant species are excellent indicators of the permanent availability of water at or very near to the surface of the ground. Certain species, such as white elm, red maple, trembling aspen, eastern hemlock and balsam poplar are often common in wetlands but they may also be found in uplands and, therefore, they cannot in themselves be regarded as indicators of a wetland environment.

Another major determinant of wetland boundary lines will be the presence of certain upland species that cannot survive in a wetland environment. The evaluation crew should be able to identify all upland tree and shrub species since this will greatly facilitate the accurate delineation of meaningful boundaries. Some examples of good upland indicator species are sugar maple, ironwood, American beech, bitternut hickory, red oak, black cherry, and many others. If these species are present in large numbers, then it may **not** be considered to be a wetland ecosystem. Evaluators must realize, however, that the physical and biological characteristics of some plants can vary with latitude, longitude, and altitude resulting in a some species being found in very different ecotypes.

WETLAND EDGES BORDERING ON LAKES AND RIVERS

There are some cases where very closely grouped wetlands function together as one. For example,

- areas comprised of very closely spaced small wetland ponds/pools (e.g., within 30 metres from each other) interspersed with small pockets of upland forest (e.g., a 'mosaic wetland' or a' slough wetland')
- wetlands along a river of lake that are separated by 100 feet or less

Due to their unique nature, these types of wetlands are to be evaluated as one wetland under OWES (e.g., small individual wetland ponds are not to be evaluated separately).

In this evaluation system, lakes are defined as:

> *"Areas of open water that are greater than 8 ha in size and at some location are greater than 2 m in depth from the normal low water mark"*

Many wetlands border on lakes, rivers, streams and reservoirs. The deep water boundary of such wetlands should be drawn at approximately the 2 m depth of the **seasonally low water level** (Section 1.2.2 provides additional instructions for mapping vegetation communities in/adjacent to open water). Some special situations or exceptions to the above rule are as follows:

1. Unvegetated open water areas on the lake side of a barrier beach are not considered to be wetlands (the barrier beach is included as part of the wetland except where vegetation is dominated by upland species).

2. Non-vegetated embayments or ponds <2 m deep which border on or are more or less surrounded by wetland vegetation should be considered as part of the wetland unless they are along the outer edge of the wetland adjacent to water greater than 2 m deep. NOTE: Completely unvegetated open water < 2 m deep located along the outer edge of the wetland is to be excluded from the wetland map (see Figure 2)

3. Mudflats or sandy beaches that are not separated from the wetland by a barrier beach are to be included in the wetland.

4. Vegetation communities that are dominated by emergent vegetation and are in water >2 m in depth are to be included as part of the wetland. Note that this applies **only** to those communities in which emergent vegetation is the dominant form (see Appendix 8).

5. For wetlands along lakes, rivers and reservoirs, the two shoreline limits may be defined by placing a compass point at the extreme end point of shoreline emergent vegetation and the pencil at the 2 m depth line (Figure 2). An arc is drawn to shoreline past the emergent vegetation. The same procedure is then repeated to define the boundary in any other open water boundary of the wetland. Submergent or sometimes emergent vegetation may be present in the open water within the arc. This approach has been used successfully along the Bay of Quinte and on the islands off Kingston. Alternatively, points of land or other shoreline discontinuities may be used to define the "upshore" or "downshore" end point of the wetland.

Wetlands on Ontario's major lakes and rivers

There are a number of additional criteria that may be used to establish the open water boundaries of wetlands on the St. Mary's River, Georgian Bay and Lakes Huron and Superior:

1. The 2 m depth contour (at low water) is to be used to define the deep water boundary of these wetlands (see exceptions above). If the evaluator encounters underwater shoals or knolls rising like islands from deeper water and the tops of these are less than 2 m from the surface, they should be included in the wetland map and the wetland with which they are associated is to be defined as one wetland and evaluated as such.

2. For wetlands along the St. Mary's River, the upriver and downriver limits of the wetland are to be determined by the field evaluator. Some of additional criteria to be used are provided below.

Limits of Wetlands that Follow Meandering Streams

Often, a narrow band of wetland vegetation will be found along the banks of a slow moving stream or river. Such wetlands offer both water and excellent "edge" for fish and wildlife. The wetland may be more or less continuous for many kilometres. The evaluator will have to consider various sorts of discontinuities such as steep banks, rapids, beaver dams, presence of agricultural lands, etc., and include the justification for delimiting the upstream and downstream wetland boundaries in the data record.

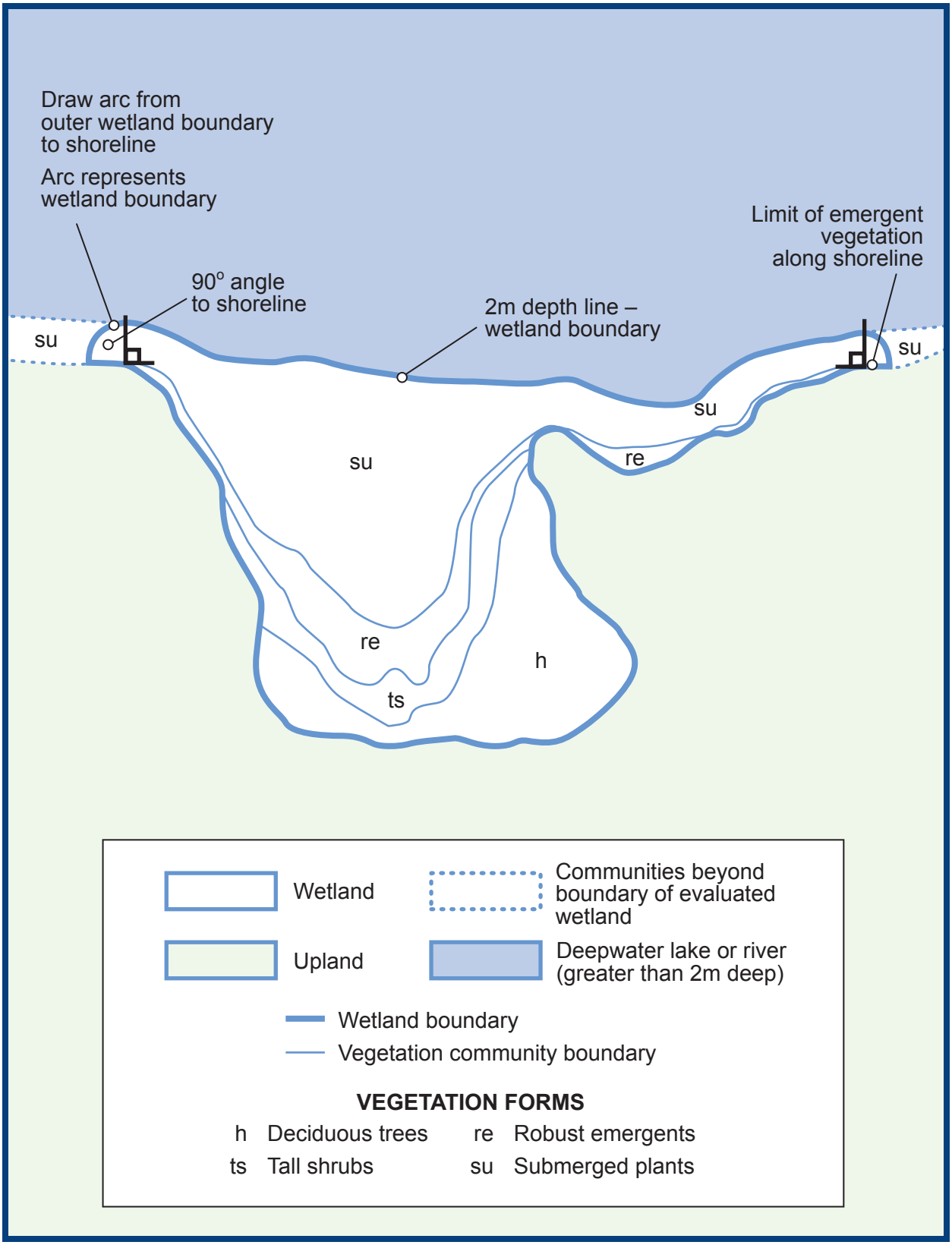


Figure 2: Aerial view illustrating outer wetland boundaries on deepwater lakes and rivers.

WETLANDS BORDERING ON AGRICULTURAL FIELDS, PASTURE OR URBAN DEVELOPMENT

Often wetlands will border on agricultural fields, pasture or urban development where a portion of the wetland has been drained or converted to alternate human uses. Areas that no longer meet the definition of a wetland (in terms of water, soil and vegetation characteristics) should not be mapped as wetland. Conversely, abandoned farmland that, at the date of the evaluation, meets the definition of wetland should be evaluated.

Similarly, agricultural land that has retained the defining characteristics of a wetland should still be evaluated as wetland. Cattle pasturing or grazing, while resulting in some degradation in the quality of the wetland, will usually allow the wetland to persist. For example, a swamp where plants have been heavily grazed, but where the site still meets the 50% wetland vegetation rule and exhibits wetland functions (e.g., wildlife habitat, hydrological, etc.), should be mapped as wetland.

In the event that the former wetland has been effectively drained, wetland vegetation is no longer present and a new smaller functioning wetland remains, it is the latter that should be used to establish wetland size. In those areas where the recent construction of drains is causing the wetland to be replaced by upland species, wetland boundaries should be drawn using the 50% vegetation rule.

BOUNDARIES OF WETLANDS THAT OCCUPY SEASONALLY FLOODED LANDS

Many wetlands occur along rivers or streams on seasonally flooded lands. Flood risk area mapping" or floodplain mapping of river basins may be carried out by conservation authorities, municipalities or other agencies to determine the boundaries of lands which may become periodically flooded or inundated. Again, it is the dominance of wetland plant species that is important when defining the boundary of a wetland. Again, it is the dominance of wetland plant species that is important when defining the boundary of a wetland.

A word of caution: in a hot, dry season in midsummer, a seasonally flooded wetland may appear to be very dry indeed. As noted previously, the availability of spring, leaf-off air photos (infrared, orthophotos, B&W aerial) can enhance the mapping of wetland boundaries. A spring field visit, or at least an interpretation of spring 'leaf-off' photography, contributes to an understanding of the extent of seasonal flooding and the maximum extent of the wetland.

Photo: Jan McDonnell

BEAVER-FLOODED AREAS

In most instances, beaver-flooded areas are wetlands and should therefore be inventoried, (provided that they are dominated by wetland vegetation). However, where the flooding is causing damage to farmland, roads, or other valued structures, and an active program exists to locally extirpate the beaver, the beaver-flooded portion of the wetland should not be considered for inventory.

Beaver-flooded areas are usually not permanent. Their existence depends upon availability of beaver food supply, trapping pressures, the effectiveness of control actions, and the amount of precipitation. These factors result in changes in water levels and areal extent of flooding from season to season. Once an evaluator has ascertained that a beaver-flooded area should be inventoried, then its outer boundary should be established by the presence of wetland vegetation and the 50% wetland vegetation rule. In no case should flooded areas that contain upland forest species be included in the wetland unless there is clear evidence that the beaver dam may be more or less permanent, as for example in areas of abandoned farmland.

VERY LARGE WETLANDS IN NORTHERN ONTARIO

As one moves north into the boreal forest and into the Hudson Bay Lowlands, extensive wetlands, often covering hundreds of square kilometres, dominate the landscape. This evaluation system **cannot** be used to evaluate these extensive wetlands and they must be protected through other mechanisms such as Provincial Parks, Conservation Reserves, and ANSIs, etc. There may be cases where it is important to evaluate a wetland type (bog, marsh, swamp or fen) that is completely surrounded by a large extensive wetland. For example, a lacustrine or riverine marsh that backs on an extensive black spruce swamp. Clearly, the wetland edge cannot be determined by "upland" plant communities. In these cases, the boundary line for the wetland to be evaluated may be drawn along the border of the extensive wetland type. Whenever this approach is required, the evaluator must include a detailed explanation of how the wetland edge was defined.

PREPARATION OF WETLAND MAPS

The required wetland maps are used for the determination of the wetland's evaluation score and for identifying the location and exact boundaries of the wetland. This information is essential for amendments to municipal Official Plans and zoning maps in accordance with the Provincial Policy Statement, authorized under Section 3 of the *Planning Act*. If habitat management of the wetland is contemplated, then the map becomes an essential tool for planning, monitoring, etc.

Wetland mapping must be done to a standard consistent with the Wetland data class in the Land Information Ontario (LIO) warehouse. The easiest way to ensure this is to generate all mapping using ESRI GIS software. Using said software will also aid visualization, interpretation and ensure accurate mapping.

BASIC MAPPING STANDARDS

Orthophotography, satellite imagery, or Enhanced Forest Resource Inventory (EFRI) is available for much of Ontario. Ideally, both external and internal vegetative boundaries will be digitally captured overtop of this imagery. In the event this imagery is not available hardcopy photos should be scanned and georeferenced in preparation for use in GIS software.

Spring imagery is ideal for external wetland boundary delineation as it is most likely to represent peak hydroperiod conditions and therefore the maximum extent of the wetland boundary. Photos acquired during this season are also generally pre-leaf which facilitates interpretation of deciduous and mixed swamp boundaries. Summer photography can also be useful for determining the extent of shallow water communities. If only summer photography is available for mapping, then an understanding of topography and soils is imperative. This can be achieved by viewing hardcopy photos in stereo and interpreting hardcopy soil mapping or viewing orthophotography, a digital elevation model and a soil layer in tandem in the GIS environment.

Internal vegetation communities should also be mapped in a GIS using orthophotography. Either spring or summer photography can be used, in tandem with field visits, as a base for mapping

Given that original digital data layers was built with traditional Ontario Base Maps (OBM's) at scales of 1:10 000 in Southern Ontario and 1:20 000 in Northern Ontario, new wetland mapping should at least be as accurate as these scales. Basic map accuracy is directly related to map scale, with horizontal accuracies at +/- 5 meters in the south and +/- 10 meters in the north. Consequently, when confounded by roads, utility corridors, rail roads and other relatively static features wetland boundaries must be horizontally accurate to these standards. For example, a wetland boundary abutting a road must be horizontally accurate to +/- 5 or +/-10 meters (depending on location in Ontario). In some cases it may be possible to map wetlands at finer scales of 1:5 000 or 1: 2 000. Such mapping is now possible with higher resolution digital orthorectified imagery.

Meeting accuracy standards when mapping in GIS using orthophotography is automatic since these data are at least ten times more accurate than original digital data layers. Scanning and referencing hardcopy photography conforming to the standard methods will ensure mapping meets the basic horizontal accuracy standards.

INTERPRETIVE MAPPING STANDARDS

The text above describes mapping standards in regards to wetland boundaries that are restricted by static, mainly anthropogenic, influences. Most often wetland to upland transition generally occurs over larger distances subject to frequently fluctuating environmental conditions. These areas are therefore much harder to map, quantify and evaluate. For example, the distinction between swamp and upland forest is often determined using the 50% wetland vegetation rule, a decision making process that is influenced by site conditions at time of field visit. Consequently, horizontal accuracy standards are lower at +/- 30 meters to account for interpretation subjectivity and seasonal change.

See Sources of Information (page 9 and Appendix 2) for a list of information that can be used to support preparation of wetland maps.

USE OF INTERPRETED, REMOTELY-SENSED IMAGERY (E.G., AERIAL PHOTOS; DIGITAL ORTHOPHOTOGRAPHY) TO MAP EVALUATED WETLANDS

Aerial photographs, high-resolution digital orthophotography, and other imagery can be a useful support tool for wetland evaluators, e.g., for estimating the location and extent of wetland habitats.

It is recognized that photo interpretation and interpolations routinely occur, e.g., to interpret boundaries in order to make the process efficient and in those cases where landowner permission to access the property has not been granted. In these situations, interpreted boundaries would be used to supplement the field work.

In most cases, field verification is required, however, in some cases, certain portions of the wetland can be inventoried using other methods such as aerial-photography interpretations, road-side checks, etc.

Enhanced Forest Resource Inventory infrared airphoto

Forest Resource Inventory true colour orthorectified photo

MAPS TO BE PREPARED AND INCLUDED IN THE WETLAND EVALUATION FILE

1. **Wetland Boundary Map**
   Should be produced at a precision of no less than 1:10,000 or 1:20,000 scale (depending on your location in the province) and must be produced digitally using GIS systems. The Wetland Boundary Map should depict all of the outer boundaries of the wetland and any features (e.g., roads, rivers, streams, etc.) within or adjacent to the wetland. The map might also depict any land use adjacent to the wetland. The map should be accessible in ArcGIS format (i.e., a shapefile) and depicted in either digital image or PDF format.

2. **Vegetation Community Map**
   This map should include all boundaries depicted in the Wetland Boundary Map as well as all internal vegetation community boundaries determined during the evaluation. The Vegetation Community Map should include field codes and community codes for each community depicted so that it can be cross-referenced with information recorded in the Wetland Data Summary Form. It also should include depiction of surface water flows and the direction of flow. NOTE: this map may be combined with the Wetland Boundary Map (#1, above) into one map product.

3. **Catchment Basin Map.**
   This map should show boundary of the wetland's catchment and all of its detention areas, including its wetlands and other additional wetlands or water bodies. NOTE: This map can be 'coarse' (i.e., all vegetation communities in the wetland need not be included) – its purpose is to clearly indicate that all other catchment areas were considered when calculating hydrological scores.

MEASURING WETLAND SIZE

Once the wetland map is complete and final, the size of the wetland can be easily measured in GIS. Use of GIS and digital photography adequately accounts for air photo distortion. Appendix 2 provides a lot of mapping resources that may be useful when evaluating wetlands. Once mapping is complete, the size of each vegetation community can also be determined.

One method that can be used to generate the necessary size metrics involves simple GIS queries and summaries to generate total wetland size, size of vegetation community and percentage of total wetland area each vegetation community accounts for. This method is the easiest and most accurate approach.

CREATING THE VEGETATION COMMUNITY MAP

Prior to conducting field work it is important to create a first estimate of vegetation community boundaries. This can be done digitally using GIS or in hardcopy on GIS air photo printouts. Aerial photographs, high-resolution digital orthophotography and other imagery can be useful support tools for wetland evaluators. Digital images/maps can be printed in hardcopy or uploaded to a portable digital device and revised in the field.

As much as possible, wetland vegetation communities should be visited to document the dominant and subdominant vegetation forms. It is recognized that photo interpretations routinely occur in the field to determine boundaries in order to make the process efficient. Interpreted vegetation boundaries can be used to supplement field work. Purely remote-based interpretations (i.e., no field work) are not a replacement for field verification.

Each vegetation community should be assigned a field number that is recorded both on the hardcopy field map and in the field notebook or on the field data form.

In the field notebook, record all relevant information for each vegetation community:

- dominant form
- other vegetation forms
- dominant plant species for each form
- percent open water in community
- estimate of high and low marsh
- soil type
- hydrological site type
- presence and abundance of invasive species
- note exact location of significant species and record abundance, behaviour and other pertinent observations
- note photograph numbers, if you take any
- presence of seeps, iron precipitates, marl deposits and laggs
- direction of water flow

The amount of open water, significant species, and other features can vary among vegetation communities. As a result, evaluators should assign a different numerical field code to **each community** mapped, even if there is a similar community with identical vegetation forms in a different part of the wetland.

Community and outer wetland boundary lines may require modification in the field. Boundaries between vegetation communities exist where there is a change in the combination of forms, or the dominant form. Since vegetation communities often intergrade, use the criteria outlined above to delineate boundaries between zones of gradual ecological change.

Swamp forest communities may sometimes be difficult to distinguish from upland forest on the photographs. Forest Resource Inventory (FRI) maps can sometimes be of great help in delineating such essential boundaries. For example, dominance by tree species typical of wetlands can often be seen on FRI maps.

The final wetland map is constructed by converting field notes to final wetland types and community codes. Wetland types and sub-types are designated by letters and vegetation communities are designated by numbers.

M = marsh
W = open water marsh
S = swamp
F = fen
B = bog

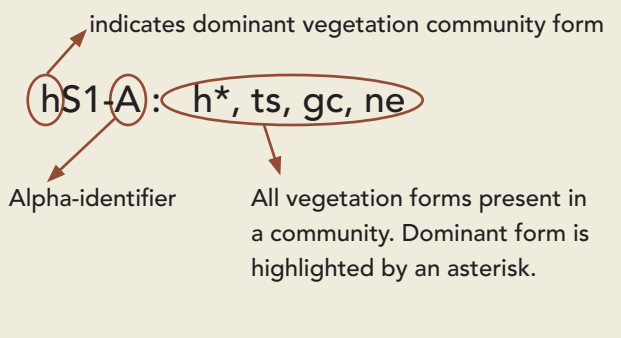
When the wetland map is prepared, several vegetation communities in one wetland may be grouped together under the same community code. This grouping occurs where both the dominant form and the subordinate forms in several field communities are all the same (i.e., the forms are the same but the dominant species are often not). For example, three communities in different parts of the wetland may have the following forms: h, ts, gc, ne with h (deciduous trees) as the dominant form. However, community A may have red maple as the dominant species; community B, black ash and community C, white elm. Similarly, the subdominant forms may be dominated by different species. See Figure 3 for an example of a vegetation community map.

In some cases, it may be desirable to prevent the loss of information about dominant species or substrates, an identifier can be attached to the map code in each community so that it can be related back to the original field record. In the example described above, the three hS1 communities would be labelled hS1-A, hS1-B and hS1-C. There is still only one four-form community to

be scored and the method does not result in any new lines being drawn on the map. Thus, the scores for vegetation communities and interspersion are not affected. Evaluators should ensure that such alpha labelling of vegetation communities remains unique (i.e., have only one hS1-A community in the entire wetland).

If the forms are the same but the dominant form is different, you can identify two different communities. For example, an area of h, ts*, gc, ne and an area of h*, ts, gc, ne are different communities and are denoted as S1 and S2. However, an area of h*, ts, gc, ne and an area of h*, ts, gc, ne may have different dominant species but, since the forms and dominant form are the same, they are both denoted as the same community (S1) and each receive an alpha-identifier (hS1-A and hS1-B).

Consider the following examples:



Example 1: same vegetation forms but different vegetation forms dominate (thus no need for the extra alpha identifier)

Community Code	Vegetation Forms	Dominant Species
tsS1	h, ts*, gc, ne	speckled alder (ts)
hS2	h*, ts, gc, ne	black ash (h)

Example 2: same vegetation forms but different species represent dominate vegetation form

Community Code	Vegetation Forms	Dominant Species
hS1-A	h*, ts, gc, ne	red maple (h)
hS1-B	h*, ts, gc, ne	black ash (h)

The standard Wetland Evaluation Data Summary Form (see Appendix 4) must be used and kept in the wetland file.

Open Water Marsh vs. Marsh

In contrast to the other three wetland types, marsh communities are separated into two categories: open water marsh and marsh. All communities dominated by submergents (su), floating plants (f), free floating plants (ff) or unvegetated (u) are considered to be open water marsh communities and designated by "W". Communities dominated by narrow-leaved emergents (ne)(1), robust emergents (re), broad-leaved emergents (be) or herbs (gc) are considered to be marsh communities and are designated by "M". Nevertheless, **all** marsh communities, whether designated by "M" or "W" are numbered consecutively.

For example;

su W1
ne M2
re M3
ff W4

(1) NOTE: While most ne-dominated communities are marsh, an exception is made for communities dominated by Wild Rice or Hard-stemmed Bulrush. These two species often occur in permanent open water associated with submergent, free-floating aquatic plants and can thus be designated as open water to better characterize the wetland type.

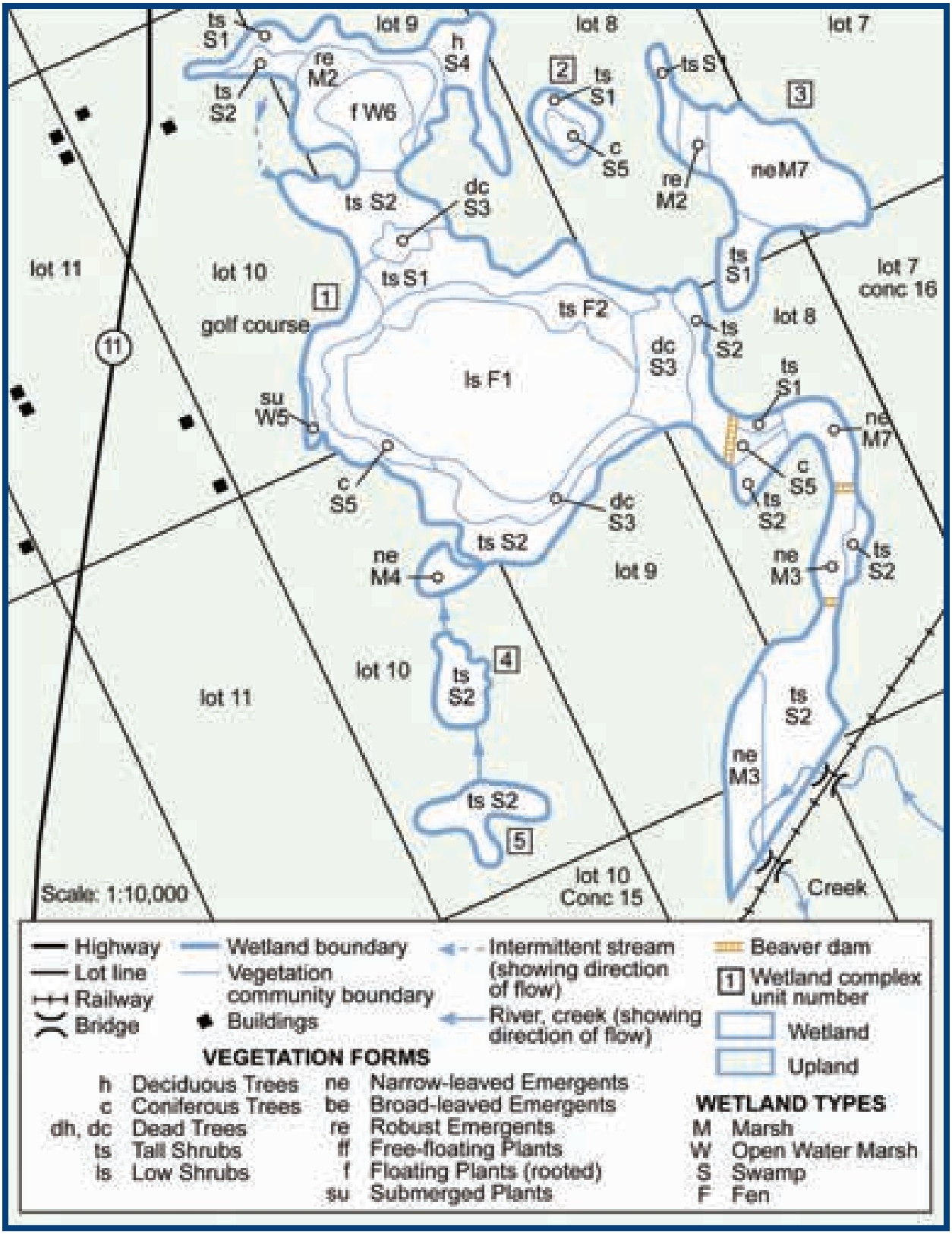


Figure 3: A vegetation community map categorized by wetland type and vegetation form. An explanation of the numbering system used in this map is provided in the Creating the Vegetation Community Map section.

1.0 BIOLOGICAL COMPONENT

Photo: Regina Varrin

The biological component includes three subcomponents: productivity, biodiversity, and size. Productivity is evaluated by assessing three attributes: growing degree-days/soils, wetland type and site type. Biodiversity is evaluated using six attributes: number of wetland types, vegetation communities, diversity of surrounding habitat, proximity to other wetlands, interspersion, and open water type. Size is evaluated by recognizing that some of the biodiversity attributes have the effect of dramatically increasing the overall ecological quality of the wetland. Thus, through size, the causal link is recognized between selected biodiversity attributes and the species richness and abundance of wildlife in the wetland.

The scores of the biological component recognize that strong linkages often exist between productivity, biodiversity and a wetland's hydrological setting. When such linkages exist, biological and ecological values of a wetland may be substantially increased. Specific hydrological circumstances in a wetland make possible the presence of certain ecosystem processes and functions. A good example of linkage between biology and hydrology occurs when a rich fen develops because of secure mineral water discharge. Another example is the relation between vegetation and nutrient availability since the latter is controlled in large part by the form of water input. The fact that groundwater discharges into a particular wetland can have a very significant effect on the biological, social and some special feature scores of the wetland. For example, if nearby development activities were to affect the hydrological function, this could ultimately reduce or even eliminate various biological, social and special feature values in the wetland or in wetlands downstream.

This evaluation system recognizes the effects of certain hydrological/biological linkages in the productivity and biodiversity subcomponents. In effect, certain wetlands will receive hydrologically generated points in the biological component. This method of scoring points is also present in the hydrological component where "water quality improvement" (caused by the actions of living organisms) is evaluated in the hydrological component. These examples of linkages demonstrate that ecosystem processes and functions are very much interconnected and interdependent. As well, these linkages show that we are dealing with highly complex dynamic systems.

1.1 PRODUCTIVITY

Biological productivity is a reflection of the ability of an area to produce "biomass" as measured by the production of living organisms, regardless of species. When biomass is produced by chlorophyll-bearing organisms, productivity is said to be **primary** (plant biomass). When produced by plant-eating organisms (herbivores), productivity is said to be **secondary**. When produced by non-chlorophyll bearing organisms that consume (eat) herbivores (i.e. carnivores), biological productivity is said to be **tertiary**.

The form of "energy" that is available to herbivores and carnivores is that derived from eating primary producers. Herbivorous animals are said to be secondary producers in that they are entirely dependent upon plants. In turn, the herbivores themselves are the essential food for a wide range of carnivores (from the smallest invertebrates to the larger wildlife species). Yet another group of organisms called detritivores produce fresh biomass by consuming only dead plants and animals or absorbing and mineralizing organic molecules derived from decomposition. Tertiary producers are said to be at the "top of the food chain". Thus, primary production is considered to be a good indicator of the overall biological productivity; the more energy available from primary production, the more "consumers" the ecosystem can support.

Because primary productivity provides a good general approximation of both secondary and tertiary productivity and because the evaluation of secondary and tertiary productivity is usually a complex and time-consuming matter, only primary productivity is considered in the biological component. Some aspects of secondary and tertiary productivity are evaluated in the Special Features Component.

While this evaluation uses the language of economics to talk about the natural creation of biomass (e.g., production, producers, consumption, consumers), it is important to recognize that we are dealing with species and complex ecosystems which have taken millions of years to evolve and which have ecological functions and values far beyond production and consumption.

1.1.1 Growing Degree-Days/Soils

Both temperature and soils have a direct bearing on primary productivity of a wetland. Hence, in this evaluation these two attributes are evaluated together.

The single most important factor contributing to the creation of biomass is temperature (Leith and Whittaker 1975, Edey 1977). Thus, across the breadth of Ontario, most species of plants growing in their natural environment will produce more biomass at 15° C than they would at 10° C. This means that, in general, more species of animals (invertebrates and vertebrates) can be sustained by wetland communities that grow in areas with more favourable temperature regimes. An index which shows the contribution of warmer temperatures to plant growth has been created (Brown *et al.* 1968) by recording the seasonal accumulation of "Growing Degree Days" (GDDs) above 5.5° C. This base temperature is chosen for the index because plant growth stops at lower temperatures.

GDDs are not necessarily related to plant hardiness. Plant hardiness zone maps are created for use in agriculture and horticulture and they are based on actual experience by growers in different parts of the country with frost sensitive as well as species of native and non-native crop plants, garden plants and the like which require certain temperature levels. Depth of protective snowfall, the occurrence of frost and fog, and other climatic factors are important in determining hardiness zone maps. As wetland species are native, the notion of GDDs is accepted as being more accurate for assessing productivity.

The concept of GDDs assumes that plant growth is related directly to the average daily temperature. It ignores water, nutrients, light, water body morphology, rate of grazing or harvesting, nature of drainage and kinds of vegetation forms present. Assuming that other things are equal, the direct correlation between GDDs and plant biomass is a positive one.

The number of GDDs across the landscape of Ontario has been calculated (Brown *et al.* 1968; Environment Canada 1982). The map in Figure 5 shows the number of accumulated GDDs above 5.5° C (42° F) for northern Ontario. The GDDs range from 3200 in the south to less than 1600 as one approaches the shores of Hudson Bay.

GDDs are determined from Figure 5. The evaluation should be expressed as a range in which a wetland occurs; no attempt should be made to guess an absolute number.

For wetlands located within more than one GDD isogram interval, the following criteria should be followed:

- If the wetland is a single contiguous wetland, record and score for the higher GDD intervals,

The contribution of substrate type to productivity is well established both in agriculture and forestry. The inclusion of substrates in the determination of wetland productivity is based on the assumption that higher biological productivity will result when certain substrate capability groups are present. Mineral substrates are considered to be more valuable to productivity than organic substrates even though it was the presence of a wetland environment that created the organic substrates in the first place.

Organic soils predominate over large areas of landscape both in lowlands and Shield regions. One of the characteristics of northern Ontario wetlands is the enormous accumulation of organic soils, caused mainly by the growth of *Sphagnum*. The accumulation of these mosses continues over thousands of years giving rise to extensive peatlands. Organic soils are widespread in northern Ontario because much of the landscape consists of extensive areas of clay flats or "belts" with very low inclines and therefore "poor drainage." As well, enormous regions are comprised of slightly elevated bedrock where extensive "perched" wetlands are common.

A perched wetland is one that develops in an area positioned at an elevation higher than surrounding lowlands. It is underlain either by impermeable bedrock or impermeable clays so that its water supply can be said to be "secure". In perched wetlands organic soils accumulate incrementally over thousands of years. The bogs and fens with deep organic layers that dominate much of the landscape of northern Ontario are the result of this process. This does not mean that swamps and marshes are absent; they develop in many local sites, mainly along actively flowing streams and rivers and on lakeshores subject certain kinds of flooding or to the impact of wave action.

It takes hundreds or thousands of years for thick layers of organic substrates to develop. Organic substrate cannot develop unless a wetland has a secure, non-fluctuating or "reliable" water supply. Water can hold only small amounts of oxygen and hence, oxidation in soil saturated with water is extremely slow. Due to rapid growth of many species of *Sphagnum* mosses (and some other genera), net accumulation of peat is the norm for the bog and fen wetlands which are so widespread in the north. Northern wetlands which accumulate peat are frequently termed peatlands (Riley and Michaud 1989; Riley 1987, 1988).

Mineral substrates in wetlands occur in limited and localized areas, e.g., in riverine marshes, deltas and some swamps and in fens which may develop on limestone seepage areas. Mineral substrates are usually characteristic of riverine flood plains and similar areas where water levels fluctuate greatly from season to season or year to year and where, because of oxidative processes, organic substrates cannot develop.

While soil maps are available for most areas in southern Ontario to assist with evaluation, this is not the case in the north. Soil maps may be available for some areas through the Ontario Institute of Pedology at Guelph.

Some surficial geology maps (at the scale of 1:506,880) with useful soils information are available from the Ontario Institute of Pedology. These may also be of value for the Hydrology Component. These are:

S1-65	Kenora-Rainy River
S2-65	Thunder Bay
S3-65	Algoma, Cochrane,
S4-65	Algoma, Sudbury, Timiskaming and Nipissing

As well, in 1987 the Ontario Geological Survey has issued a map (No. 2518; scale 1:1,200,000) on the surficial geology of northern Ontario.

Maps should be reviewed prior to field work in order to identify those areas within the wetland for which soil designations do not exist. Identify substrate type to the greatest detail possible from the maps using the "soil type" or "soil name" in the legend of the map. Where a combined substrate type is shown (e.g., sandy loam) the second term is the dominant type and is used for scoring. For example, E (Ecclestone) "lacustrine silt loam" would be recorded as loam. Organic substrates are often simply recorded as "muck" and field checking is necessary to determine the appropriate category for scoring.

It is essential to keep field records of substrate characteristics in all evaluations of northern wetlands. Soil sample locations should be indicated on the wetland map.

A soil auger extending to at least 60 cm should be carried in the field and used to sample substrates in each vegetation community. The soil auger or

your paddle (in open water areas) can often be used to determine the depth of organic to mineral or to bedrock substrate. There is no need to determine the substrate depth if it is over 40 cm and likewise there is no need to determine substrate depth in a lakeside marsh after your paddle finds a "bottomless" organic deposit. What is expected is that the percent of area occupied by substrate groups in the evaluation have been recorded.

In lakes, one sometimes finds soft, oozy, semi-suspended substrate sometimes containing calcareous invertebrate shells. Such substrates should be designated as organic. Substrates in the flowing channel of riverine wetlands are mineral. If uncertain about whether a substrate at a particular spot is organic or mineral, the evaluator should use the following criteria (Ecological Land Classification Working Group In prep; Soil Classification Working Group 1998; Soils and Substrates Ontario Working Group In prep.):

Organic = **(a)** >40 cm depth of organic over mineral substrate; OR
(b) Where organic substrate lies atop bedrock and is > 10 cm in depth
Mineral = <40 cm depth of organic over mineral substrate

The following descriptions adapted from a Ducks Unlimited guide to field identification of Ontario soils may be useful:

MINERAL SUBSTRATES

Clay: Moist soil moulds easily and makes a long continuous ribbon when pressed between thumb and fingers. If the ribbon breaks off after an inch or so, there is some silt or sand mixed in, making it a clay loam.

Silt: Has a floury or talcum-powder feel when dry and is only moderately sticky and plastic when wet. It may have a soft velvety feel when moist. A thumb print often shows up well in a moist silty soil. Silt may also show some cohesion if a piece is removed from a soil profile.

Sand: Medium to coarse sand feels rough, has visibly larger grains, and has little if any structure when dry, i.e. the grains will flow individually like grains of table salt.

ORGANIC SUBSTRATES

These soils contain greater than 30% organic matter.

Fibric: The least decomposed of all organic soil materials. There are large amounts of well-preserved fibres that are readily identifiable as to their botanical origin. This soil type has a rubbed fibre content of more than 40% of the organic volume, i.e. after rubbing the sample between thumb and fingers under running water, more than 40% would not be washed away as fine particles but would remain as definite fibres.

Mesic: The intermediate stage in decomposition. Has a rubbed fibre content of between 10 and 40% of the organic volume. It feels and looks sort of matted but it is hard to say for sure what the original plant was, and after rubbing between thumb and fingers in the field, much less is left as fibres.

Humic: Most highly decomposed. Has a rubbed fibre content of less than 10% of the organic volume. While not always, often the blackest colour of the three categories (mesic often browner). When rubbed between fingers, little if any matted feeling left. It feels more like a greasy slipperiness.

Appendix 9 provides more information on substrate characteristics that may be helpful to evaluators when determining soil type.

Scoring of GDD/Soils:

1. Determine the correct GDD value for your wetland (use Figure 5).
2. Select the appropriate GDD value from the evaluation table
3. Determine the fractional area of the wetland for each soil type.
4. Multiply the fractional area of each soil type by the applicable score in the evaluation table.
5. Sum the scores for each soil type to obtain the final score (maximum score is 30 points).

EVALUATION:

Growing Degree-Days	Clay-Loam	Silt-Marl	Lime-stone[1]	Sand	Humic-Mesic	Fibric	Granite[2]
<1600	12	11	9	7	7	6	4
1600-2000	15	13	11	9	8	7	5
2000-2400	18	15	13	11	9	8	7
2400-2800	22	18	15	13	11	9	7
2800-3000	26	21	18	15	13	10	8
>3000	30	25	20	18	15	12	9

(1) Included in this category are: limestone, dolostone, marble, and calcareous shale
(2) Included in this category are: granite, gneiss, sandstone, and non-calcareous shale

NOTE: For those wetlands occuring on gravel, choose the substrate which best describes the gravel material - i.e. is it limestone (calcareous) or granite (non-calcareous) in origin.

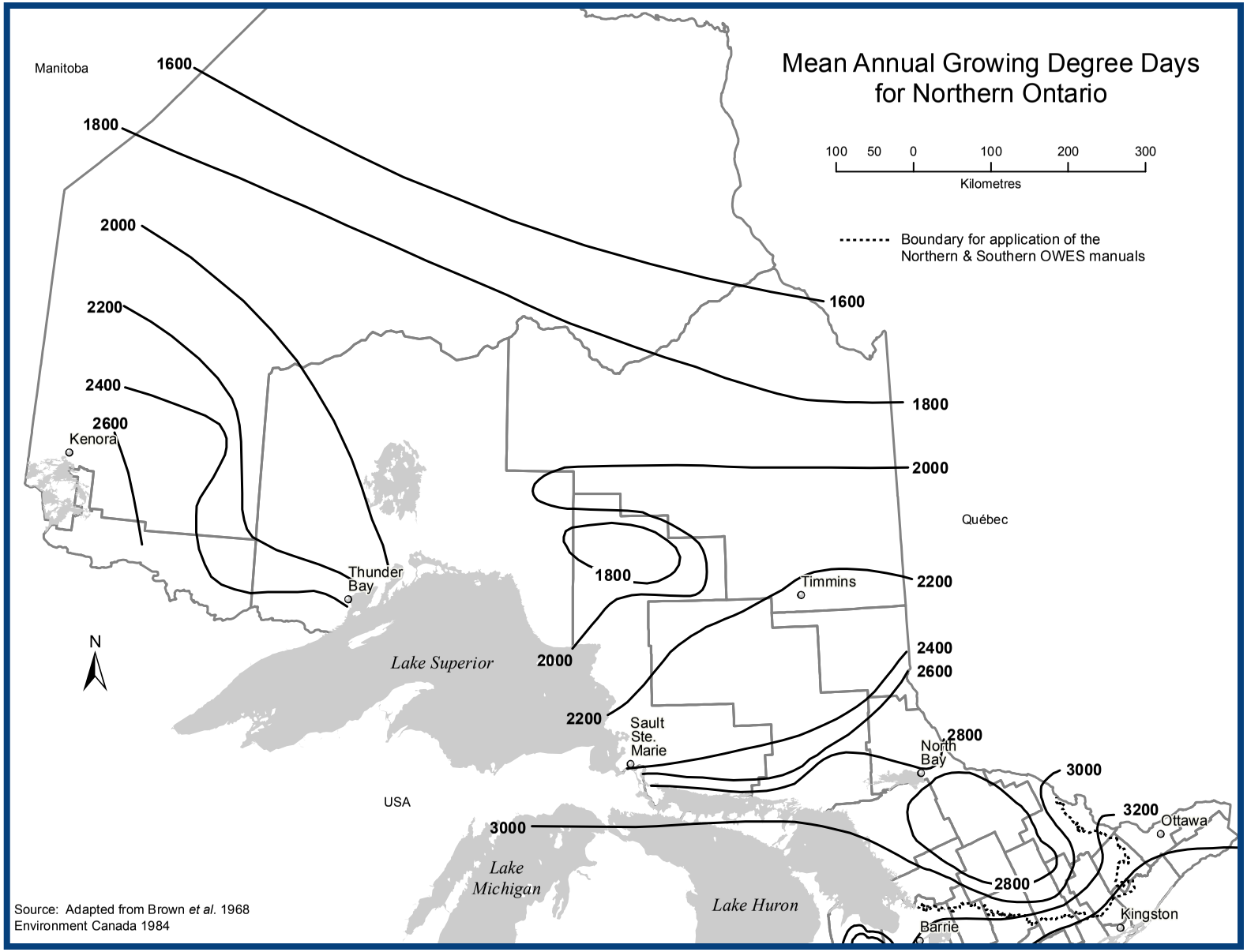


Figure 4: Mean Annual Growing Degree Days for Ontario (adapted from Brown *et al.* 1968)

1.1.2 Wetland Type

Wetlands may be comprised of different kinds of ecosystems such as marshes, swamps, bogs or fens. These are based upon definitions of Jeglum *et al.* (1974), Zoltai *et al.* (1975), Riley (1983), Damman and French (1987), and the Canadian Wetland Classification System (but with "marsh" and "open water" types combined, as noted above), and are known in the evaluation as wetland types. Although the Canadian Wetland Classification System (Environment Canada 1987) uses the term "wetland class" for these same ecosystems, the term "type" is used in this evaluation system. The Canadian Wetland Classification System recognizes five wetland types (marsh, fen, bog, swamp and shallow open water). However, in this evaluation system marsh and (shallow) open water are treated as two categories of the marsh wetland type.

Wetland types differ in their typical form (appearance), in the numbers and kinds of both plant and animal species present and in their relative rates of primary productivity. It is well established that different ecosystems have different rates of productivity (Leith and Whittaker 1975) and wetlands are no exception (Greeson *et al.* 1979; Richardson 1978). Richardson (1978) studied the net primary productivity of a variety of wetland types and derived the following average figures:

- cattail marshes = 27.4 metric tons/hectare/year;
- reed marshes = 21.0 metric tons/hectare/year;
- sedge marshes = 10.4 metric tons/hectare/year;
- swamp forests = 10.5 metric tons/hectare/year;
- bogs, fens & muskegs = 9.3 metric tons/hectare/year.

Wetland types are determined by the field evaluator on the basis of the major plant associations and physical, substrate and hydrological information obtained in the wetland and immediate surroundings. Any particular wetland may be comprised of one or more wetland types. The percent of total wetland area occupied by each wetland type must be determined from the wetland vegetation map as this will provide a more accurate assessment of productivity. The minimum size of a wetland type for mapping purposes is typically 0,5 hectares. when mapping at a finer scale of 1:5,000 or 1:2,000, or when highlighting a specialized community. Some examples include: a small kettle wetland with an open water central pond ringed by emergent marsh, a small floating fen at the edge of a swamp or marsh, and a tiny bog located within a fen or swamp. Vegetation communities should be discernable as polygons that reflect a break in wetland type or dominant vegetation form.

The four wetland types are often contiguous. Whenever two types are contiguous, the ecotone (width of transition vegetation) may be gradual or more abrupt (Gore 1983; Jeglum *et al.* 1974; Sorensen 1986; Damman and French 1987). The following descriptions of wetland types are based on Zoltai *et al.* (1975) and Riley (1994).

BOGS

Bogs are peat-covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly *Sphagnum*. The water table is at or near the surface in the spring, and slightly below during the remainder of the year. The mosses often form raised hummocks, separated by low, wet interstices. The bog surface is often raised, or, if flat or level with the surrounding wetlands, it is virtually isolated from mineral soil waters. Hence, the surface bog water and peat are strongly acidic and upper peat layers are extremely deficient in mineral nutrients. Peat is usually formed in situ under conditions of closed drainage and low oxygen levels.

Bogs may be treed or treeless but the tree cover does not exceed 25% and consists largely of black spruce (*Picea mariana*). Tamarack (*Larix laricina*) may be present but only in small numbers and usually only near the edge. For OWES purposes bogs may support more than 25% cover of live tall shrubs, typically stunted black spruce. Bogs are frequently characterized by a layer of ericaceous shrubs such as leatherleaf (*Chameadaphne calyculata*). Although bogs are usually covered with *Sphagnum*, they also can support sedges such as few-flowered sedge (*Carex oligosperma*) among others.

Photo: Sam Brinker

The following criteria can assist evaluators in the identification of a bog. They are listed in order of importance. If all of the first 5 criteria are not met then it is not likely that the wetland is a bog.

1. Raised peat hummocks are present.
2. The wetland is ombrotrophic, i.e., dependent on atmospheric moisture for its nutrients
3. There is low plant diversity (usually less than 14 species of vascular plants)
4. Few or no fen indicator plant species are present
5. Few or no tamaracks (*Larix laricina*) or eastern white cedar are present.
6. Low pH (often less than 4.7)[1]
7. Tree cover does not exceed 25 %[2]

1. See Harris *et al.* (1996) and Riley (1994). In a wetland evaluation context measurements of pH may help corroborate identification of wetland type, but they are not mandatory.
2. For OWES purposes wetlands with tree cover (> 6 m tall) equal to or greater than 25% (absolute cover) are defined as swamps.

FENS

Fens are peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. Fen peats generally consist of mosses and sedges. *Sphagnum*, if present, is usually composed of different *Sphagnum* species than occur in bogs. There are two main fen types: nutrient-rich fens typically are fed by groundwater and have a high pH. Nutrient-poor fens, such as those in moraine-dominated landscapes, can occur in isolated depressions with less groundwater inputs and a lower pH (but not as low as in bogs). Nutrient-poor fens usually develop in situations of restricted drainage where oxygen saturation is relatively low and mineral supply is restricted. Usually very slow internal drainage occurs through seepage down very low gradient slopes, although sheet surface flow may occur during spring melt or periods of heavy precipitation or if a major local or regional aquifer discharges into the wetland. Rich fens can develop directly on limestone rock where minerotrophic waters are emerging through constant groundwater discharge.

Fens have a higher diversity of plants compared to bogs which typically have less than 14 species of vascular plants. The presence of fen indicator species is a key to identifying this wetland type. For example, several moss species with narrow pH tolerances are common in fens and, if the evaluator is able to identify them, can be used as fen indicators. *Sphagnum* species may form a mat in poor fens, however they can be absent from rich fens. Fens can be dominated by sedges and grasses, especially in rich fens. Low shrubs, e.g., sweet gale (*Myrica gale*) or ericaceous species can occur with the latter particularly common as a low shrub layer in poor fens. Sometimes there is a tall shrub layer that can exceed 25% cover, and this often includes stunted tamarack (*Larix laricina*) and eastern white cedar. There can be a sparse layer of trees, often of tamarack or eastern white cedar (*Thuja occidentalis*) and, in poor fens also black spruce (*Picea mariana*). **Live tree cover can't exceed 25%. If live tree cover is greater than 25% then the area must be identified as a swamp even if fen indicator species are present.**

Peatland Terminology

"Peatland" is a general term for all types of peat-covered lands. Peat is defined as partially decomposed plant material that accumulates under saturated soil conditions.

Peatlands develop via an interaction of climate, hydrology, topography, chemistry and vegetation succession. A common method of describing peatlands is based on the degree to which the peatland receives groundwater as compared to only precipitation (Mitsch and Gosselink 2000):

Photo: Sam Brinker

- Rich fens, also known as minerotrophic peatlands, are true fens that receive water that has passed through mineral soil and typically have a high groundwater level and occupy a low point or relief in a basin.
- Poor fens, also known as mesotrophic peatlands, are intermediate between mineral-nourished (minerotrophic) and precipitation-dominated (ombrotrophic) peatlands.

- True raised bogs, also known as ombrotrophic peatlands, have developed peat layers higher than their surroundings and receive nutrients and other minerals exclusively by precipitation.

Kettle Peatlands

"Kettle" landforms are depressions in the landscape, e.g., topographic low areas on bedrock. In many cases, they have been formed as a result of glacial activity. Large blocks of ice broke off the edge of retreating ice lobes during the last glaciation and became covered by glacial outwash. When the ice melted, kettle holes were left in the outwash plains. Many of these depressions became small lakes or ponds with limited outflow but many others have filled in with peat deposits and peatland vegetation. They are referred to as "kettle peatlands".

Kettle peatlands can be found in various areas of Northern Ontario. Examples include the Chapleau moraine in northeast Ontario, and those associated with surface water systems such as the Dog, Eagle-Finlayson and Trout Lake drainages in the northwest. Northern kettle peatlands generally are poor fen and bog systems, reflecting acidic and low nutrient conditions. Those situated over calcareous materials typically are intermediate to poor fens.

SWAMPS

Swamps are wooded wetlands with 25% cover or more of trees or tall shrubs (see below for exceptions to the 25% woody vegetation rule).

In swamps, standing to gently flowing waters occur seasonally or persist for long periods on the surface. Frequently there is an abundance of pools and channels indicating subsurface water flow. The substrate is usually continuously waterlogged. Waters are circumneutral to moderately acid in reaction, and show little deficiency in oxygen or in mineral nutrients. The vegetation cover may consist of coniferous trees and/or deciduous, tall shrubs, herbs and mosses. Many swamps are characteristically flooded in spring, with dry relict pools apparent later in the season.

Swamps include both forest swamps (having mature trees) and thicket swamps (or shrub carrs). Thicket swamps are characterized by thick growths of tall shrubs such as willow species, red-osier dogwood, buttonbush and speckled alder. Both forest and thicket swamps have similar characteristics of water levels and chemistry. Both are assessed as "swamp" wetland type, but can be distinguished by the predominance of either "tree" or "shrub" form. Silver maple, hybrid soft maple, white elm, black/green ash and yellow birch are among the best indicators of a deciduous swamp while black spruce, eastern hemlock, tamarack and black spruce indicate conifer swamps. Black spruce, eastern hemlock and yellow birch, however, also grow well in upland sites.

Photo: Sam Brinker

Photo: Sam Brinker

MARSHES (includes OPEN WATER MARSHES)

Marshes are wet areas periodically inundated with standing or slowly moving water, and/or permanently inundated areas characterized by robust emergents, and to a lesser extent, anchored floating plants and submergents. Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mud flats. Water remains within the rooting zone of plants during at least part of the growing season. The substratum usually consists of mineral or organic soils with a high mineral content, but in some marshes there may be as much as 2 m of peat accumulation. Waters are usually circumneutral to slightly alkaline and there is relatively high oxygen saturation. Marshes characteristically show zones or mosaics of vegetation, frequently interspersed with channels or pools of deep or shallow open water. They include open expanses of standing or flowing water which are variously called ponds, shallow lakes, oxbows, reaches or impoundments. Marshes may be bordered by peripheral bands of trees and shrubs but the predominant vegetation consists of a variety of emergent non- woody plants such as rushes, cattails, bulrushes, sedges, grasses and herbs. Low shrubs such as sweet gale, red-osier dogwood, water-willow, and winterberry may also occur. Where open water areas occur, a variety of submerged or floating plants flourish, such as stonewort (*Chara*), pondweeds, water-milfoils, waterweeds, bladderworts, coontails, tape-grass, water lilies, duckweeds and watermeals.

Mapping Ecotonal Areas between Wetland Types

In ecotonal areas (where one wetland type intergrades into another) the field evaluator should apply consistent rules, as described below, in mapping the boundary between types. The rules are applied in the field and later when making extrapolations from field-verified data on aerial photos.

Marsh/Swamp Ecotone:

Trees are defined as woody plant species greater than 6 m in height. Tall shrubs are woody plants from 1-6 m in height, and low shrubs are woody plants <1 m in height.

"25% woody vegetation rule": To map the dividing line between marsh and swamp, the evaluator should use this rule. Thus, if over 25% of the vegetation at a particular spot (absolute cover) includes live tall shrubs and/or trees, the area should be designated as a swamp. If less than 25% of the area is dominated (absoloute cover) by live tall shrubs and/or trees, it would be a marsh. It is important to note that the ecotone between marsh and swamp is based upon the presence and abundance of live **tall** shrubs and **live** trees.

Exceptions to "25% woody vegetation rule":

- Marsh and swamp communities often contain low shrubs. If low shrubs dominate 50% or more of an area (absolute cover), it must be considered a swamp community. If low shrubs dominate between 25% and 49% of an area, it is a marsh

- A community with 30% coverage of tall shrubs and 70% coverage of emergents would be considered to be swamp. Any marsh areas within the swamp community that are at least 0.5 ha in size should be delineated as a separate vegetation community and described as such. In cases where only dead trees are present (beaver floods, reservoirs) in what is otherwise a marsh, the evaluator cannot use the 25% rule since the area functions mainly as a marsh and should be so designated. Only if a wetland is dominated by extensive stands of dead trees (greater than 70% cover) should it still be designated as a swamp.

Treed Fen/Treed Bog/Conifer Swamp Ecotone:

It is sometimes difficult to distinguish between these three kinds of wetlands. However, wetlands with more than 25% cover by black spruce are swamps. **Note that** for OWES purposes treed bogs and fens may have more than 25% cover of live tall shrubs. The evaluator should consult the detailed descriptions above.

Open Fen/Marsh Ecotone:

In highly calcareous areas, as for example where marl is abundant or extensive limestone dominates the lands around a wetland, one may find open fen at the edge of deeper water with bulrush and *Chara*. In such areas, the open water should be designated as marsh, and associated shoreline vegetation as fen. Such transitions are found on Manitoulin Island.

All other Ecotones:

The descriptions of the four wetland types provided above should be used for mapping all other areas where transitions between contiguous wetland types are found.

Appendix 10 contains information on wetland type indicator species and Appendix 8 contains a key to wetland types, both may aid in determining wetland type.

EVALUATION (1.1.2):

In wetlands with more than one wetland type, first calculate the fractional area of each wetland type (FA = area wetland type/total wetland area), then calculate partial scores for each type. Sum the result to obtain the final score.

Bog	=	FA x 3
Fen	=	FA x 6
Swamp	=	FA x 8
Marsh	=	FA x 15

(*maximum score 15 points*)

1.1.3 Site Type

The physiographic position of a wetland in the landscape defines its site type. Four fundamentally different site types are defined in this evaluation. These are: isolated, palustrine, riverine and lacustrine. Riverine and lacustrine are further subdivided because the location of a wetland on a lake or river has a bearing on nutrient concentrations of the water and hence upon productivity. From headwaters to mouth, a river system presents a continuous gradient of physical conditions (Vannote *et al.* 1980).

The site type of a wetland strongly influences its productivity based upon different sources supplying nutrients. For example, isolated, and palustrine sites are considered to have low productivity since they rely on rainfall, some overland flow, and in some cases, groundwater seepage to supply nutrients. Lacustrine wetlands vary from moderate to high productivity. Some lakes have constant flushing. However, in most lacustrine wetlands, there is no constant flow of water to replenish nutrient supplies. Productivity of riverine sites increases with distances downstream, and is very high for rivermouth wetlands. This relation is based on the principle, demonstrated by Hynes (1970), that level of nutrients in an unpolluted stream increases naturally from the headwaters to the mouth.

While there are different definition for hydrological site type, for the purposes of this manuals, the definitions that will be used are presented below and illustrated in Figure 6.

Photo: Rebecca Zeran

With the exception of isolated sites, any particular wetland, depending on its size, complexity and physiographic position, may be comprised of one or more site types. By definition, isolated wetlands are found alone and do not include elements of the other three site types. Where a wetland is comprised of several site types, the field evaluator should record a site type for each vegetation community recorded in the field. The overall percentage of each site type can then be calculated by adding the areas of each vegetation community. In some cases, consideration of contour lines on a topographic map may help to delimit types from each other. Always document the direction of flow or absence of water in drains, creeks, inflows and outflows in the wetland and in its immediate periphery while in the field. This information on directions and amounts of flow should be entered on the wetland map.

EVALUATION:

Isolated	FA x 1
Palustrine (permanent or intermittent outflow)	FA x 2
Riverine	FA x 4
Riverine (at rivermouth)	FA x 5
Lacustrine (at rivermouth)	FA x 5
Lacustrine (with barrier beach)	FA x 3
Lacustrine (exposed to lake)	FA x 2

(*maximum score 5 points*)

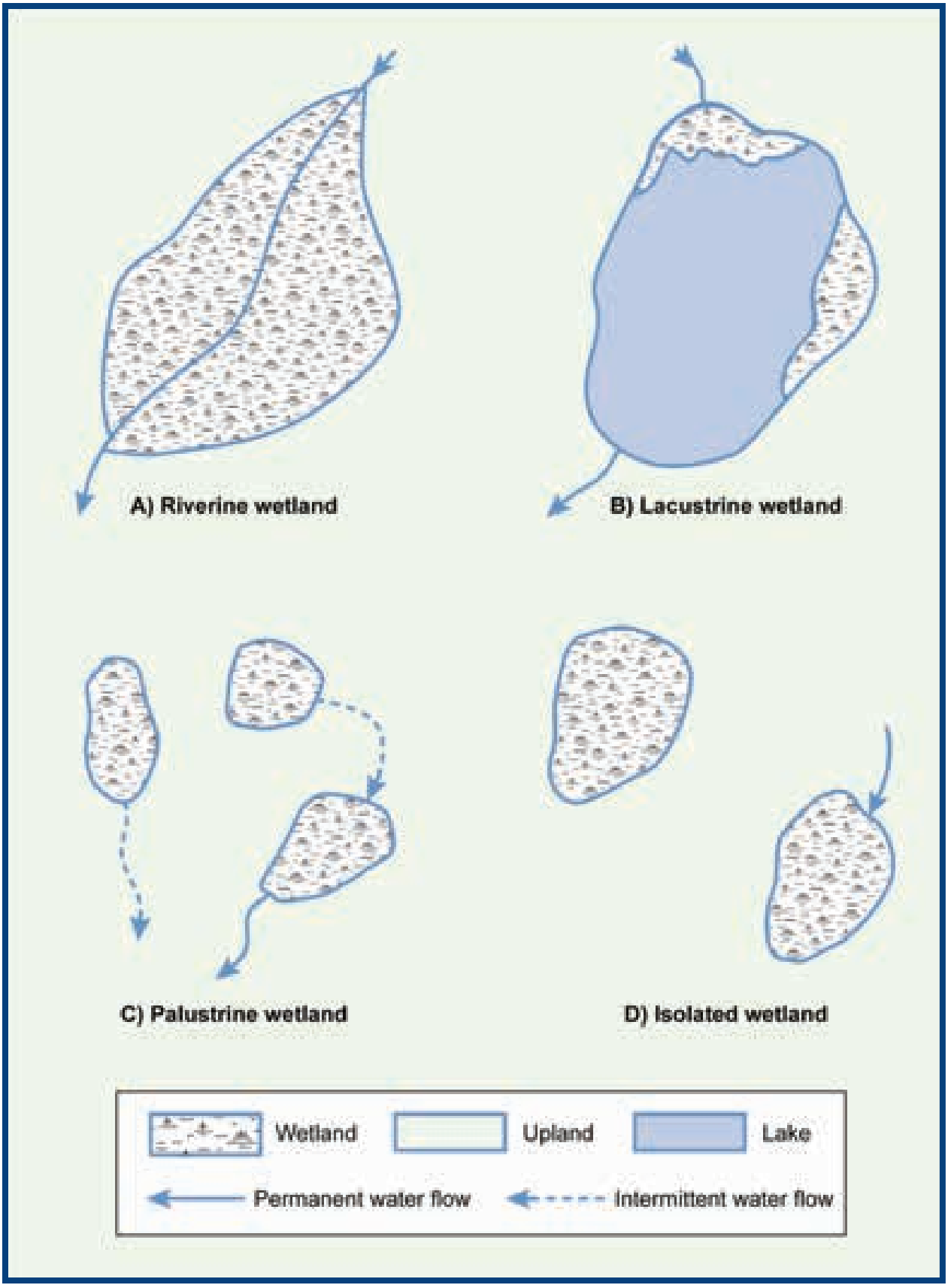


Figure 5: Wetland Site Types: A) Riverine, B) Lacustrine, C) Palustrine, D) Isolated

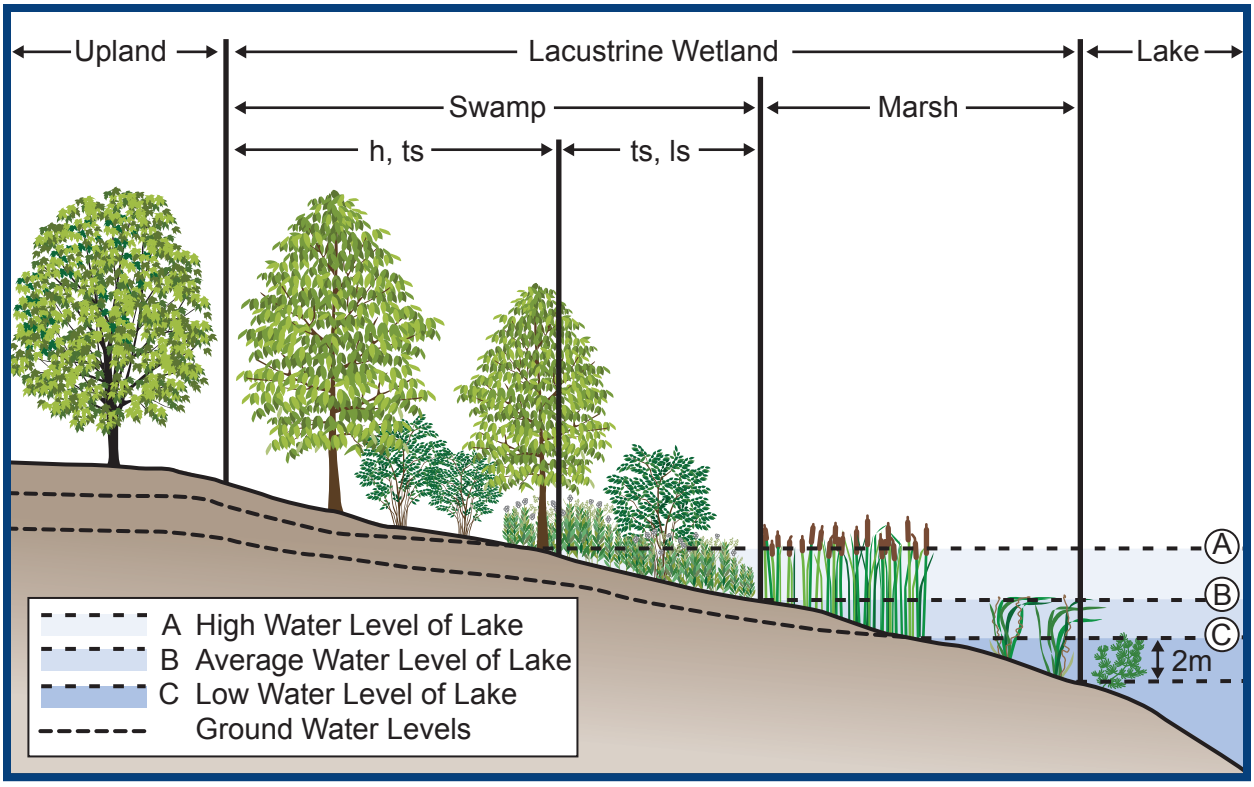


Figure 6: Lacustrine Site Type

LACUSTRINE

Lacustrine wetlands (Figure 7) are associated with lakes. In this evaluation system, lakes are defined as:

> *"Areas of open water that are greater than 8 ha in size and at some location, are greater than 2 m in depth from the normal low water mark."*

Lacustrine wetlands include areas normally covered by the seasonally high water level i.e. where the vegetation is influenced by changes in lake level. By rule, wetlands adjacent to lakes greater than 8 ha are considered to be partly or entirely lacustrine. Flooded areas caused by storm surges may sometimes look like lakes; however, the basic riverine or palustrine site type of such wetlands should be recognized. Three categories of lacustrine site are recognized:

1. Lacustrine (at rivermouth) – where a river or stream enters a lake and forms a "rivermouth" wetland;

2. Lacustrine (with barrier beach) – where a wetland is separated from a lake by a barrier beach in which lake waters may from time to time be sealed off; and

3. Lacustrine (exposed to lake) – where a barrier beach is not present.

When a wetland forms at the edge of a reservoir larger than 8 ha, it should be considered as lacustrine (exposed to lake). For purposes of this evaluation, however, wetlands along any of Ontario's five major rivers (Ottawa, St. Clair, Detroit, Niagara, and St. Lawrence) should be considered to be riverine or riverine (at rivermouth) as described below.

Where a wetland is a combination of two lacustrine site types, as for example, lacustrine both at rivermouth **and** on an enclosed bay (with barrier beach present), it is necessary to estimate the proportion of wetland area that is occupied by each site type. The evaluator must determine whether the dominant influence is exerted by the rivermouth location or by the lakeshore barrier beach.

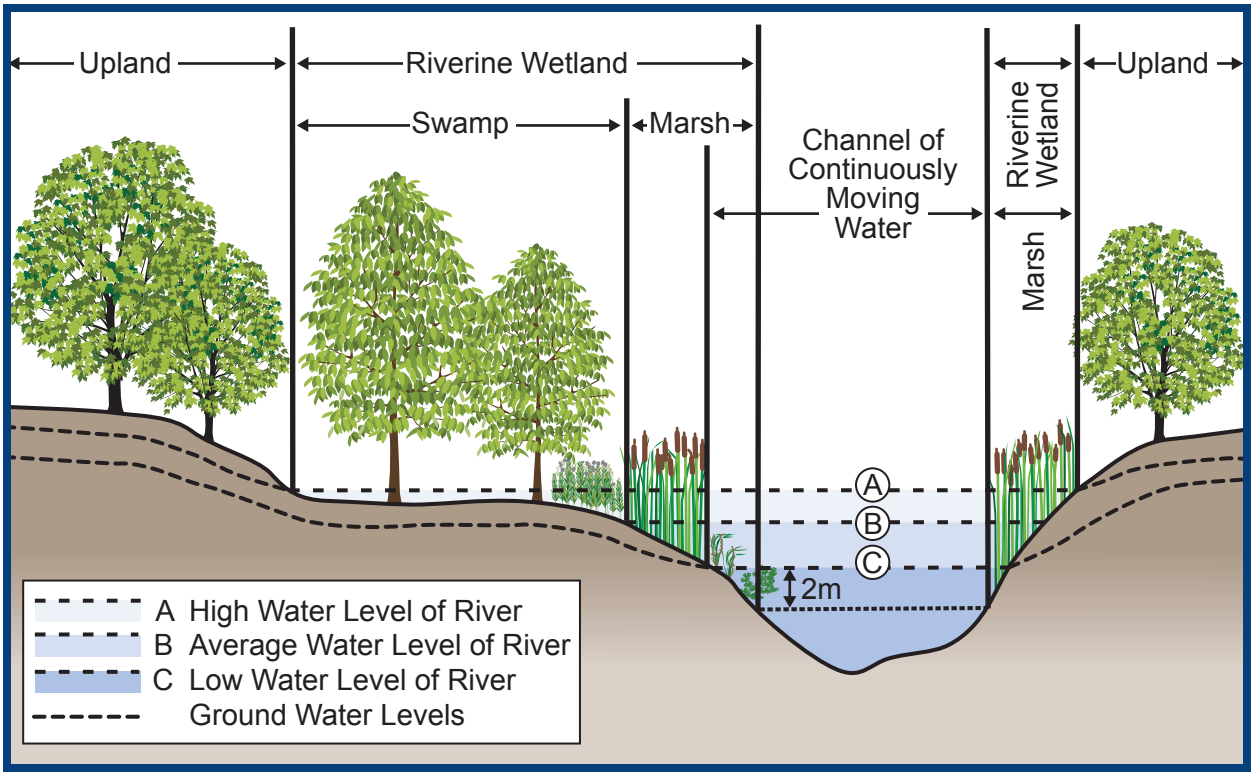


Figure 7: Riverine Site Type

RIVERINE

Riverine wetlands (Figure 8) include the channel of continuously moving water to the 2 m depth, as well as adjacent wetlands and normal flood plains of rivers and **permanent** streams (if flow is not permanent then the wetland is palustrine). "Flood plains" are the relatively smooth valley floors adjacent to and formed by alluviating rivers (geological definition, Dictionary of Scientific & Technical Terms, McGraw Hill 1974). The upland edge of riverine wetlands is located at the interface between upland and wetland vegetation (see Introduction for discussion of boundary delimitation).

A separate category of riverine wetland is recognized — riverine-at-rivermouth — similar to the lacustrine-at-rivermouth category. It applies **only** to wetlands formed where a river or stream enters a major river. For northern Ontario, only, the St. Mary's River is considered to be a "major river".

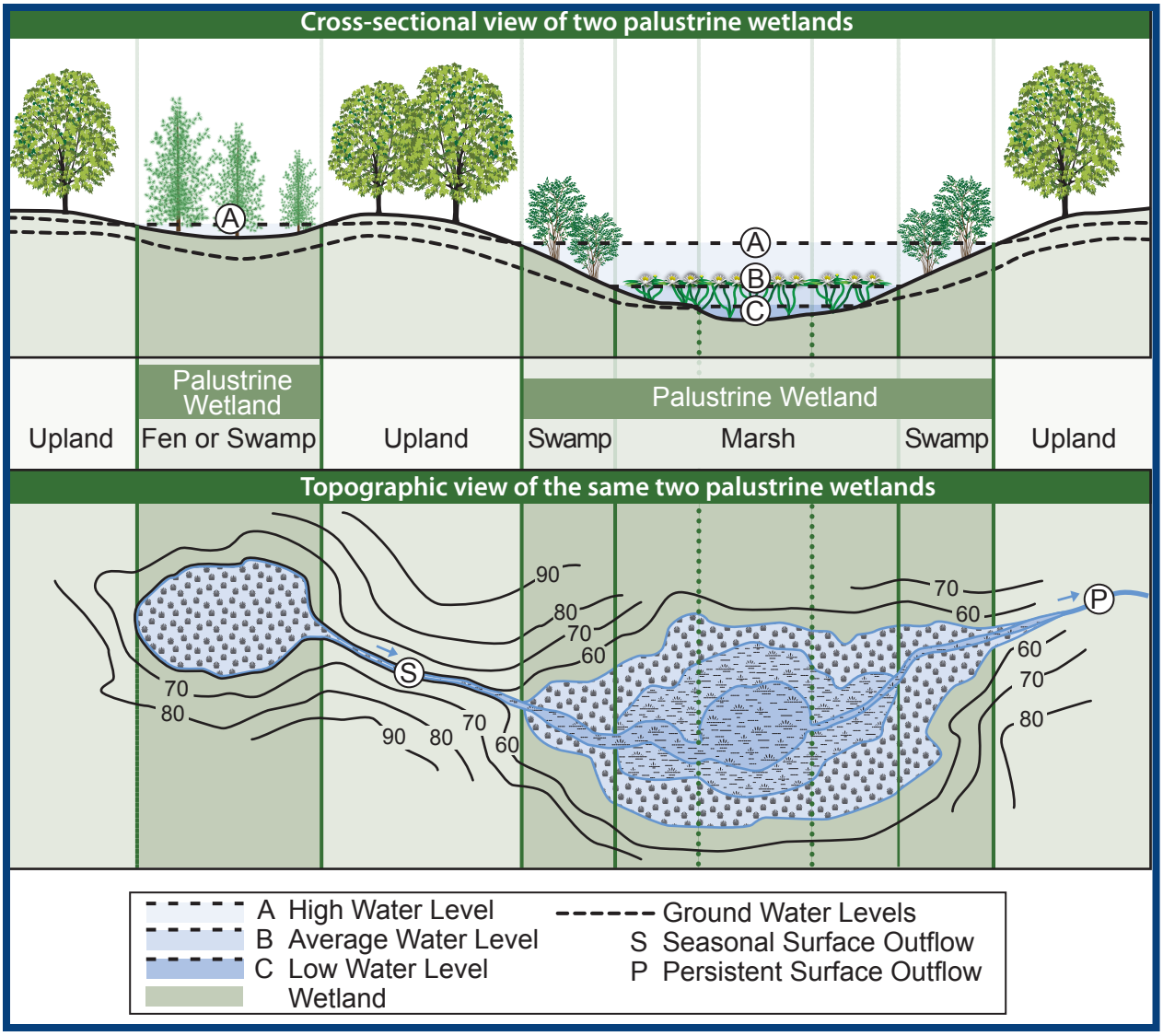


Figure 8: Palustrine Site Type

PALUSTRINE

Palustrine wetlands (Figure 9) generally occur in lands positioned physiographically upslope from lacustrine and riverine wetlands. For this evaluation system, palustrine wetlands are defined by either absent or intermittent inflow **and** either intermittent or permanent outflow. They are often found in headwater areas and may drain in opposite directions into different streams or river basins.

In wetlands where a small intermittent stream joins a large permanent stream or river, all the wetland area which drains into the small stream is palustrine but the part adjacent to the larger permanent stream or river is riverine.

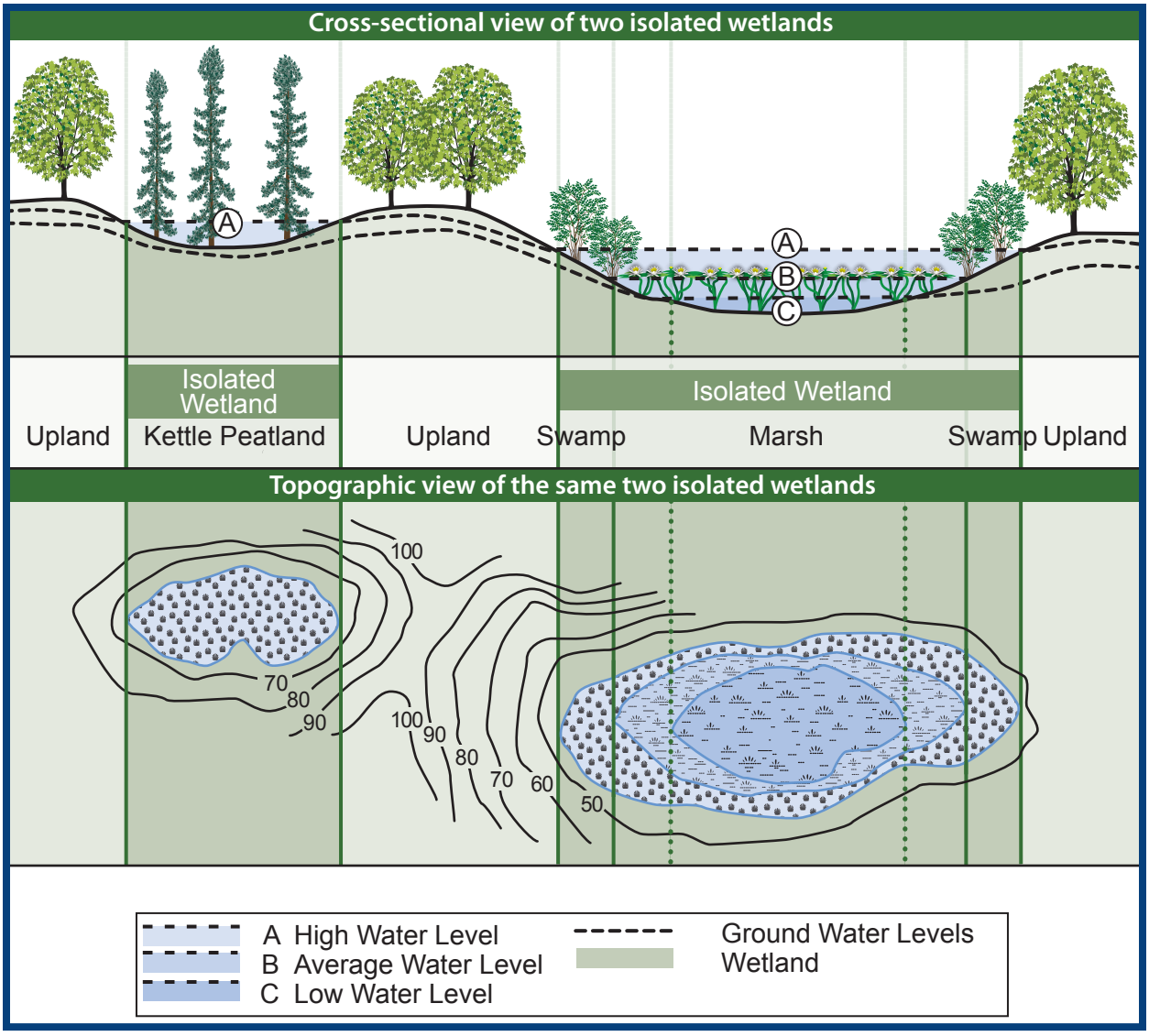


Figure 9: Isolated Site Type

ISOLATED

Isolated wetlands (Figure 10) are defined as wetlands that have *no surface outflow*. The sources of nutrients to isolated wetlands can include precipitation, diffuse overland flow and occasionally groundwater. Examples of isolated wetlands might be found in depressions in upland moraines, areas of major relief breaks, kettles, or depressions among drumlins. If a wetland has a surface water outflow of any kind, it may not be considered to be isolated.

1.2 BIODIVERSITY

The Ontario's Biodiversity Strategy, 2011 defines biodiversity as the variety of life on Earth. It includes all living things and the ways that they interact with each other and their environment. There are three levels of biodiversity:

- Genetic diversity: the variety of genetic information contained in individual organisms.
- Species diversity: the variety of species
- Ecosystem diversity: the variety of habitats, ecological communities and ecological processes.

The biodiversity of wetlands varies. Wetlands containing more habitats will contain more plant variety and will in turn attract far more animals (from microorganisms, to invertebrates and vertebrates) than wetlands containing more uniform vegetation communities or monocultures of plants (Greeson *et al.* 1978). Simply put, wetlands with greater ecological variety meet the living requirements of more species.

The benefits of biodiversity both to humans and to the ecological health of an area (and the larger region) are of great importance because of the link between greater diversity of habitats and the greater numbers and abundance of plant and animal species. As well, the variety of living things working together maintains the ecological processes of the planet.

1.2.1 Number of Wetland Types

The more wetland types (i.e. swamp, marsh, fen or bog) that are present within a single wetland, the more diverse the habitat available for wildlife and the more kinds of microorganisms, invertebrates, vertebrates and plants are available for the support of life processes of the wetland ecosystem. Hence, the diversity of wildlife species in the wetland as a whole will be greater in the wetland ecosystem. Golet (1976) considered the number of wetland types to be a very important contributor to total biodiversity.

The scoring in the evaluation is based on the hypothesis that the addition of a second type to a wetland would increase the number of species by 50%. Thus, if a wetland type had 100 species, the addition of one additional type would add 50 more species. Hence, a factor of approximately 1.5 has been used as the increment. The principle appears fairly sound from a "values of biodiversity" standpoint. Should reliable species lists for comparing the four wetland types exist in future, these increments could be adjusted.
Boundaries between wetland types should be shown on the wetland vegetation map. The number of types should correspond to those listed in Section 1.1.2 (Wetland Types).

EVALUATION:

Number of Wetland Types

1) One = 9 points
2) Two = 13
3) Three = 20
4) Four = 30

(Score one only, *maximum score 30 points*)

1.2.2 Vegetation Communities

A vegetation community may be defined as an assemblage of plant populations living in a prescribed area. Vegetation communities provide the most important measure of biodiversity. From an ecosystems standpoint, vegetation is the most important aspect of the landscape. Trees, shrubs, herbs, mosses and other photosynthesizing organisms create the primary basis for all animal life from vertebrates to the diverse assemblages of invertebrates. Vegetation provides food for herbivores, protection from carnivores, nesting materials, places to roost and rest, and isolation during the breeding season. Vegetation also retains nutrients in the living biomass which a diverse array of detritivore invertebrates and fungi recycle to support the vegetation community of the future. As well, in themselves, plant species create varied three-dimensional ecological systems whose variations provide a rich assortment of niches not only necessary for many other plant species but within which variously adapted animal life can dwell. The more kinds of niches created by plant communities in local areas or large landscapes and the greater the number of plant species within each, the more diverse will be the faunal portion of the overall ecosystem.

Most wildlife species are adapted primarily to one or a complex of vegetation forms (physiognomic types) and, as a result, wildlife diversity in any area is closely related to vegetation form and variety which, in this evaluation, is measured through vegetation communities. Communities may be characterized according to several attributes. For the purpose of this evaluation system, vegetation communities are recognized as assemblages of plant species representing one or more 'forms'. Form is the physical structure or shape of a plant, determined by such features as height, branching pattern and leaf shape. In this evaluation, there are 16 vegetation forms recognized for wetlands; these were adapted from Golet (1976) to reflect differences not only in plant structure but also in ecology and stand density. These 16 forms are listed below and illustrated in Figure 11.

h	deciduous trees	m	mosses
c	coniferous trees	re	robust emergents
dh	dead deciduous trees	ne	narrow leaved emergents
dc	dead coniferous trees	be	broad leaved emergents
ts	tall shrubs	f	floating plants (rooted)
ls	low shrubs	ff	free floating plants
ds	dead shrubs	su	submerged plants
gc	herbs (ground cover)	u	unvegetated

Trees and shrubs are defined as woody species with the following height categories:

Trees:	>6 m in height
Tall shrubs:	1-6 m in height
Low shrubs:	<1 m in height

NOTE: the Ecological Land Classification (ELC) system considers a "tree" to be woody species that typically adopt a single stem growth form, are capable of achieving a Diameter at Breast Height (DBH) greater than 9.5 cm and/or greater than 10 m in height, and are included in a tree list. In this Ontario Wetland Evaluation System, trees and shrubs are defined in terms of form (i.e., their height at the time of observation, **not** the height they have the potential to reach).

Each vegetation community may contain one or several combinations of vegetation forms. For example, a vegetation community in a swamp might consist of the following forms: deciduous trees (h), tall shrubs (ts), herbs (gc), and mosses (m). This community might be contiguous to another community in the swamp consisting of deciduous trees (h), low shrubs (ls), and herbs (gc). There may be several or more vegetation communities reflecting different combinations of forms, all found within one wetland type.

Dead coniferous trees (dc)

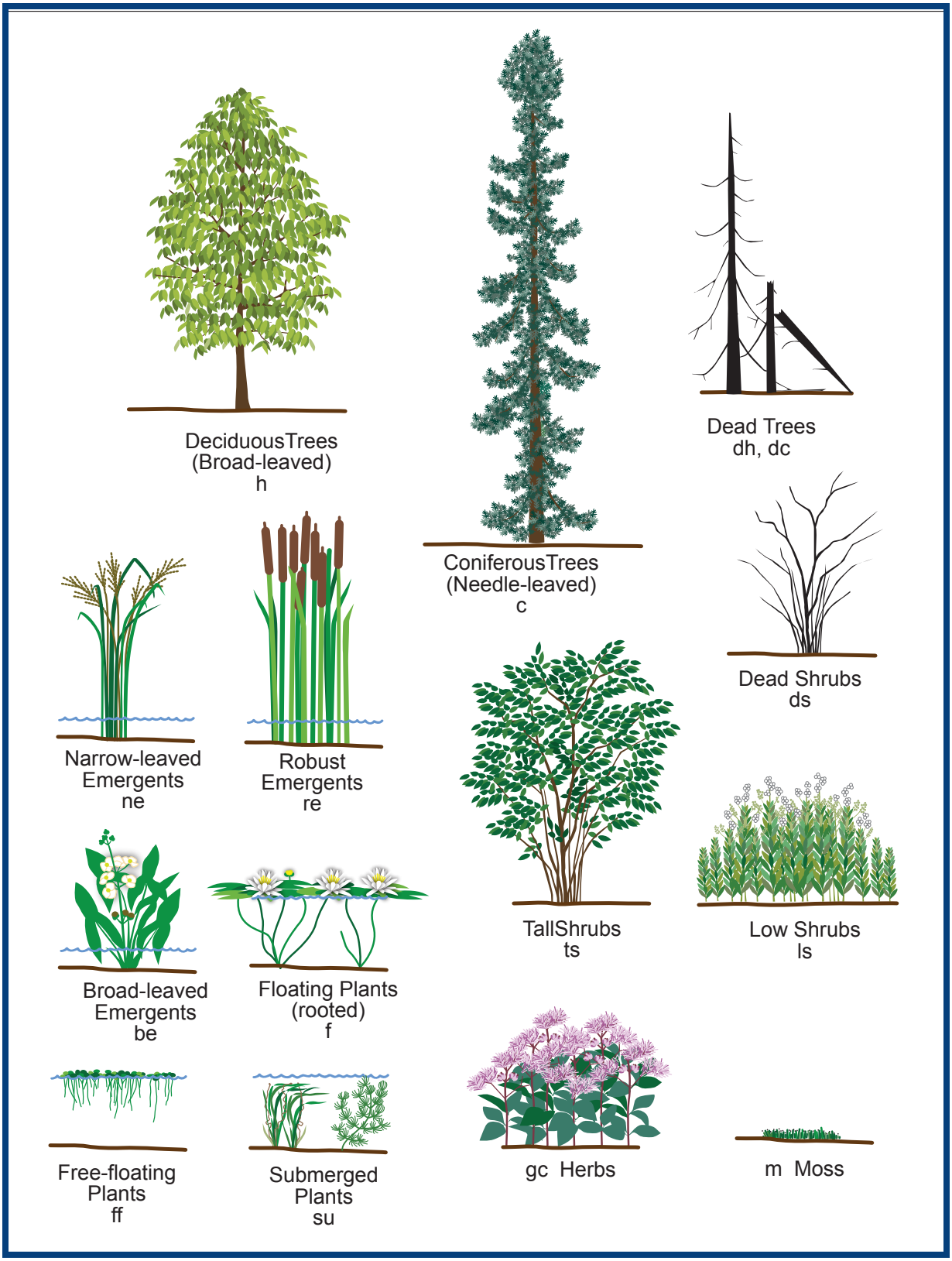


Figure 10: Wetland Vegetation Forms and Symbols

Table 1: Wetland Vegetation Form Definitions and Examples

Vegetation Form	Symbol	Definition/Description	Examples
Trees	h, c, dh, dc	Deciduous trees, Coniferous trees and Dead trees. Woody vegetation greater than 6 metres in height	red maple, black spruce, tamarack, eastern white cedar, balsam poplar, Freeman's maple, pin oak, black gum, black ash
Tall Shrubs	ts	Woody vegetation 1 to 6 metres in height, Includes stunted and sapling trees species	alders, red-osier dogwood, silky dogwood, poison sumac, nannyberry, buttonbush, shrub willows
Low Shrubs	ls	Woody vegetation less than 1 m in height, includes seedling tree species	sweet gale, swamp rose, water-willow (*Decodon* sp.), leatherleaf, labrador tea, bog laurel,bog rosemary, alder-leaved buckthorn, meadowsweet, dwarf dewberry
Dead Shrubs	ds	Dead woody vegetation less than 6 metres in height	
Groundcover (Herbs)	gc	Non-woody (herbaceous) plants growing in moist but exposed soil or, occasionally, very shallow water. Includes ferns	skunk cabbage, pitcher plant, spotted jewelweed, royal fern, purple loosestrife, sundews, water smartweed (terrestrial form), bog buckbean
Moss	m	Mosses and liverworts on the ground and on fallen logs	*Sphagnums*, brown mosses, feather mosses, liverworts, lichens, etc
Narrow-leaved Emergents	ne	Erect, rooted, graminoid monocots, including horsetails, which maybe temporarily or permanently flooded at the base but are exposed at the upper portion and typically are less than 1.5 metres in height	sedges (*Carex* species), cottongrasses, wild rice, rushes, bur-reeds (most species), grasses, spikerushs, sweetflag, bulrushes (most species), horsetails
Broad-leaved Emergents	be	Broad-leaved, non-woody herbaceous plants which may be temporarily or permanently flooded at the base but are exposed at the upper portion and typically are less than 1.5 metres in height	pickerel-weed, arrowheads, water plantains, water arum
Robust Emergents	re	Robust monocots from 1.5 to 3 metres in height which may be temporarily or permanently flooded at the base but are exposed at the upper portion	cattails, hard-stemmed bulrush, wool-grass, river bulrush, common reed grass
Floating Plants	f	Rooted, vascular hydrophytes with leaves floating horizontally on or just above the water surface	water-lilies, water lotus, pondweeds (those with floating leaves), water smartweed (floating form), water-shield, frog-bit, floating-heart, floating leaved bur-reed
Free-floating Plants	ff	Non-rooted, hydrophytes floating on or just below the water surface	duckweeds, watermeals, water-fern, aquatic liverworts (*Riccia* sp., *Ricciocarpus* sp.)
Submergent Plants	su	Rooted hydrophytes with leaves entirely under the water surface	coontails, water-milfoils, waterweeds, bladderworts, pondweeds (no floating leaves), tape-grass, stoneworts (*Chara* spp.); quillworts, water Star-grass, najas, water crowfoots, water-marigold
Unvegetated	u	Unvegetated open water areas less than 2 metres deep completely surrounded by wetland vegetation	

In this evaluation system, the minimum size of a vegetation community to be recognized for mapping purposes is typically 0.5 hectares. Vegetation communities should be discernable as polygons that define a break in dominant vegetation form or in wetland type. Exceptions to this rule can be made in cases where a highly specialized plant community occurs within a much larger wetland. Some examples of such exceptions include:

1. A floating sedge fen (which may contain some fen-loving orchids, or rare species requiring such habitat) at the edge of small lake;

2. A tiny remnant shrub or moss dominated bog within what is otherwise a treed bog or a swamp;

3. A patch of shoreline floating plants (rooted) which provide local specialized habitat required by species such as green frogs or bull frogs (and which might otherwise not be present or abundant in the wetland).

In carrying out field surveys, the evaluators must always be on the lookout for such specialized vegetation communities. They may also be identified during the preliminary aerial photograph interpretation prior to visiting the wetland. Evaluators must have rationale for the inclusion of vegetation communities under 0.5 ha.

Any one vegetation form must be present in approximately 25% of a vegetation community (absolute cover) before it is included as part of the community description. This **"25% community rule"** can be applied in areas where the intergradation between vegetation forms is very gradual. Judgement based on visual field observations should be the basis for applying the 25% rule. Note that the *same combination of forms* (i.e. the same community) will often occur in many parts of a single wetland." Each community is scored only once regardless of how many times it occurs in the wetland and regardless of whether the dominant species are different in different parts of the wetland.

Five 'exceptions' to the **"25% community rule"** exist:

1. Dead trees (dh, dc):
   Because of the value of dead trees (dc, dh) to wildlife, these forms should be included in the community description if they cover 10% or more of the community.

Photo: Regina Varrin

2. Emergent vegetation in water >2 m deep:
   Using the 25% rule, include all *emergent* vegetation in water >2 m deep as part of the wetland. Note that this only applies to emergent vegetation (see Figure 12 and 13) and will likely happen most often in wild rice beds.

3. Sparsely vegetated areas along the outer edge of the wetland but within 2 m depth:
   Map all areas with 10% or more vegetation cover as part of the wetland (see Figure 12 and 13). Areas along the outer edge of the wetland with small amounts of vegetation may be valuable to wildlife.

4. Unvegetated open water <2 m deep along the outer edge of the wetland:
   Open water <2 m deep along the outer edge of the wetland that is completely unvegetated is to be excluded from the wetland map (Figure 12).

5. Pockets of unvegetated open water <2 m deep surrounded by wetland vegetation.
   Map all areas of unvegetated open water that are < 2 m deep as a wetland community dominated by the 'unvegetated' vegetation form 'u' (Figure 12). This applies to unvegetated open water areas that are completely surrounded by wetland vegetation, and some wetland vernal pools.

The investigator must determine the composition of each vegetation community (consisting of one or several forms) and note the dominant species of vegetation for each form. These communities are summarized, coded and placed on the wetland vegetation map and legend. Figure 3 is an example of a vegetation community map.

Scoring Vegetation Communities in the Wetland Evaluation

The scoring below is based on the fact that communities with many vegetation forms will support more animal diversity than ones with fewer forms. The total scores for each category are calculated to ensure that wetlands with a greater diversity of vegetation forms and combinations of forms will accrue more points than less diverse wetlands.

Appendix 4 provides templates that will assist in organizing field data.

EVALUATION:

# of communities with 1-3 forms	# of communities with 4-5 forms	# of communities with 6 or more forms
1 = 1.5 points	1 = 2 points	1 = 3 points
2 = 2.5	2 = 3.5	2 = 5
3 = 3.5	3 = 5	3 = 7
4 = 4.5	4 = 6.5	4 = 9
5 = 5	5 = 7.5	5 = 10.5
6 = 5.5	6 = 8.5	6 = 12
7 = 6	7 = 9.5	7 = 13.5
8 = 6.5	8 = 10.5	8 = 15
9 = 7	9 = 11.5	9 = 16.5
10 = 7.5	10 = 12.5	10 = 18
11 = 8	11 = 13	11 = 19
+.5 each additional community = _____	+.5 each additional community = _____	+1 each additional community = _____

For example, a wetland with

- 3 one form communities and 4 two form communities (7 communities total = 6 points)
- 12 four form communities (= 13.5 points)
- 8 six form communities (= 15 points)

would score 35 points (i.e., 6 + 13.5 + 15 = 34.5 rounded up to 35).

(maximum score 45 points)

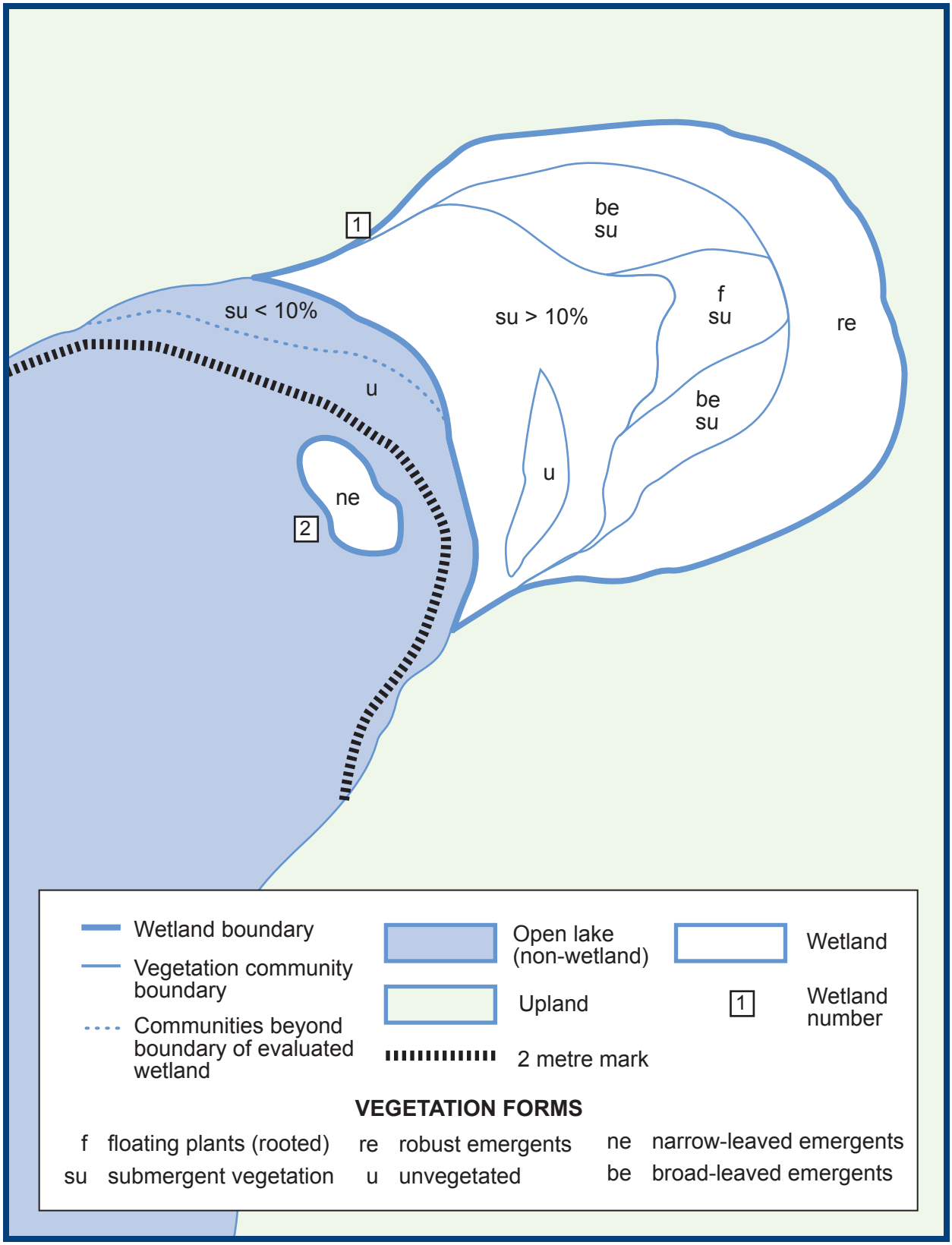


Figure 11: Aerial view showing mapping of vegetation communities and open water boundary of a wetland (see figure 12 for a cross-sectional view).

Table 2: Example showing organization of Vegetation Communities for Scoring

Number of Forms	Map Code	Vegetation Forms	Dominant Species
1 form	neM1	ne	ne, *Carex utriculata; Calamagrostis canadensis*
2 forms	reM2	re*, ne	re, *Typha angustifolia;* ne, *Calamagrostis canadensis*;
	neM3	ne*. dh	ne, *Carex utriculata, Calamagrostis Canadensis*; dh, dead deciduous trees
	tsS1	ts*, ne	ts, *Alnus incana, Salix* sp.; ne, *Carex utriculata, Juncus, Calamagrostis canadensis*
3 forms	suW4	re, su*, f	su, *Potamogeton pusillus*; re, *Typha latifolia*; f, *Sparganium fluctuans, Potamogeton natans*
	neM5	ne*, re, ds	ne, *Calamagrostis canadensis, Carex* spp.; ds, dead shrubs;. re, *Typha angustifolia*
4 forms	tsS2	ts*, ls, m, ne	ts, *Larix laricina, Alnus incana;* ls, *Chamaedaphne calyculata;* m, *Shagnum mosses;* ne, *Carex utricultara.*
	tsS3	ts*, ls, gc, ne	ts, *Alnus incana*; ls, *Alnus icana*; gc, *Onoclea sensibilis*; ne, *Carex utriculata, Calamagrostis canadensis*
5 forms	lsF1-A	ts, ls*, gc, m, ne	ls, *Chamadaphne calyculata, Ledum groenlandicum*; ts, *Larix larincina, Picea mariana*; gc, *Smilacina trifolia*; m, *Sphagnum spp*; ne, *Eriophorum virginicum, Scheuchzeria palustris*
	lsF1-B	ts, ls*, gc, m, ne	ls: *Andromeda glaucophylla*; ts: *Larix laricina*; gc: *Menyanthes trifoliata;* m: mosses; ne: *Eriophorum virginicum*; ne: *Carex oligosperma*
	neF2	ts, ls, ne*, gc, m	ne, *Carex lasiocapra*; ts, *Larix laricina*; ls, *Andromeda glaucophylla*; gc, *Thelypteris palustris*; m: mosses
Etc.,			

* Dominant vegetation community form

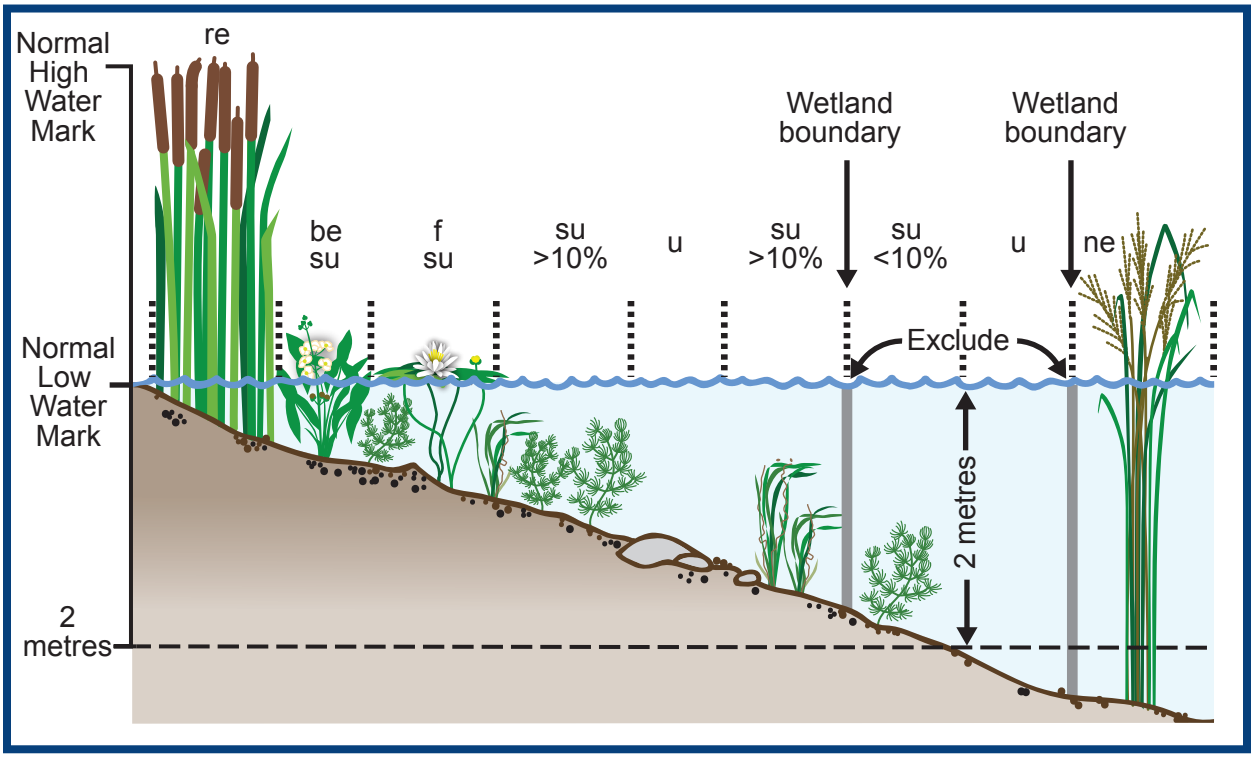


Figure 12: Cross-sectional view of vegetation communities and open water boundary of a wetland (see figure 11 for an aerial view).

1.2.3 Diversity of Surrounding Habitat

Wetlands cannot be evaluated in isolation from surrounding habitat. Many wildlife species use both upland and wetland habitat during their life cycles. In general, the greater the diversity of habitat immediately surrounding the wetland, the greater will be the diversity and abundance of wildlife both in the wetland and in its immediate vicinity. Surrounding natural habitat may serve as a "buffer", reducing disturbance and satisfying some habitat requirements. For animals requiring wetlands for a part of their life cycle (e.g., salamanders, frogs) a wetland will serve little purpose unless it is easily accessible.

Highly diverse upland habitat may include a mixture of agricultural fields, both pastured and cultivated, fence rows or shelterbelts with protective cover, forests, abandoned farmland, lakes, creeks or ponds, ravines, cutovers, and burns. Intense human activity adjacent to a wetland may deter certain species from ever using the wetland. Because of this, surrounding habitat types that reflect urbanization **do not** receive points in the scoring system.

Surrounding habitats within 1.5 km of the wetland (straight line distance, "as the crow flies") are to be scored. An area must be at least 0.5 ha in size to be considered as a distinct patch of surrounding habitat. If parts of the wetland being evaluated have been converted to alternate uses, one should consider the converted areas as surrounding habitat.

The principal sources of information on surrounding habitat will be aerial photographs and direct field observations. Judgement is to be used when including recent burns or clearcuts/cutovers.

EVALUATION:

(check all appropriate items)

_____ recent burn (< 5yr)
_____ abandoned agricultural land
_____ utility corridor
_____ deciduous forest
_____ recent cutover or clearcut (<5 yr)
_____ coniferous forest
_____ mixed forest*
_____ crops
_____ abandoned pits or quarries
_____ pasture
_____ ravine
_____ fence rows
_____ open lake or deep river
_____ creek floodplain
_____ rock outcrop

* "Mixed forest" is defined as either 25% coniferous trees distributed singly or in clumps in deciduous forest, or 25% deciduous trees distributed singly or in clumps in coniferous forest. Note that Forest Resource Inventory (FRI) maps can be misleading since 25% conifer within a unit could be entirely concentrated around a lake.

For each surrounding habitat type = 1 point
(maximum score 7 points)

1.2.4 Proximity to Other Wetlands and Waterbodies

This attribute provides a measure of habitat connectivity. The value of a wetland is enhanced when it is located near enough to other wetlands that wildlife can move between wetlands to make use of more favourable habitat, a larger food supply etc. (Golet 1976). Wetlands connected hydrologically by surface water (e.g., streams, rivers or lake shores), including intermittent connections, are most valuable. Wetland proximity can be especially important when a wetland is small and meets specialized needs of certain wildlife species.

When scoring this function, use should be made of topographic maps, spatial data, soil maps and aerial photographs but always coupled where possible and necessary with direct observations in the field. Distances between wetlands can be measured using aerial photographs or Geographic Information Systems (GIS). Distances are to be measured as straight line distance, "as the crow flies".

NOTE: If nearby wetlands or waterbodies are named, evaluators should provide details in the data record.

EVALUATION:

Check the first appropriate category.

Hydrologically connected by surface water to other wetlands (different dominant wetland type), or open lake or deep river within 1.5 km .....8 points

Hydrologically connected by surface water to other wetlands (same dominant wetland type) within 0.5 km.....8

Hydrologically connected by surface water to other wetlands (different dominant wetland type), or open lake or deep river from 1.5 to 4 km away 5

Hydrologically connected by surface water to other wetlands (same dominant wetland type) from 0.5 to 1.5 km away 5

Within 0.75 km of other wetlands (different dominant wetland type) or open lake or deep river, but not hydrologically connected by surface water.....5

Within 1 km of other wetlands, but not hydrologically connected by surface water.....2

No wetland within 1 km.....0

*(*Score highest appropriate category, *maximum score 8 points)*

1.2.5 Interspersion

Interspersion gives a measure of the presence and length of ecotones or "edges" that exist between different vegetation communities (as defined above in this evaluation). Edge refers to the line of contact between any two communities. Edge may either be relatively simple, as in the case of a shrub swamp community bordering abruptly on a cattail marsh, or more complex when many kinds of vegetation forms are present in communities in different combinations.

Most wildlife species depend upon more than one habitat type and some prefer the "edge" areas between different habitat types. Often, the number of species and the population density of some of the species are greater in the ecotone than in the communities flanking it (Odum 1971). As the interspersion of wetland vegetation increases, biodiversity within the wetland is enhanced.

Interspersion in a wetland is measured through the use of a gridded square containing equal sized squares (Figures 16 and 17). The number of times the grid lines intersect either a **wetland-upland boundary** or **vegetation community boundary** (*regardless of the dominant species*) is counted. For example (see Figure 14), you should not count an "internal" community boundary if its separating, for instance, S1-A and S1-B communities (see also "Creating the Vegetation Community Map" on pages 32-34); but you would count a boundary line for scoring interspersion if the dominant form is different (e.g., an h* dominated deciduous swamp versus a ts* dominated thicket swamp). The total gives an indication of the amount of interspersion present in the wetland. The higher the number of intersections, the more edge present.

Method for calculating Interspersion:

1. Determine the longest distance between outside boundaries of a wetland, i.e. find the widest portion of the wetland. This will require several measurements and comparisons. Draw a straight line between the two outer most points of the wetland. This line will not necessarily be oriented in a north/south or east/west position. It may be at any angle, but must be a straight line. This line (A) is fixed, and may not be moved, as it runs along the widest portion of the wetland and represents the centre line of the interspersion grid.

2. Measure the length of line A and divide by 12. This value (B) will represent the size of the squares to be used in the generation of the grid.

3. Divide line A into equal portions using value B.

4. Draw vertical lines perpendicular to line A at the marks defined by the value B. Then divide the vertical lines using the value B, thereby making a grid system of equal sized squares over the wetland map.

5. Count the number of times all horizontal and vertical lines cross the contact edge of **vegetation communities** and **upland/wetland boundaries.** When two intersecting grid lines lie directly over a community or outer wetland boundary line, it should be scored as two intersections. (See Figures 16 and 17 for an example).

NOTE: Calculation of interspersion can be facilitated by using GIS-based programs such as ArcMap.

EVALUATION:

Number of Intersections	Score
26 or less	3 points
27 to 40	6
41 to 60	9
61 to 80	12
81 to 100	15
101 to 125	18
126 to 150	21
151 to 175	24
176 to 200	27
>200	30

*(*Score one only, *maximum 30 points)*

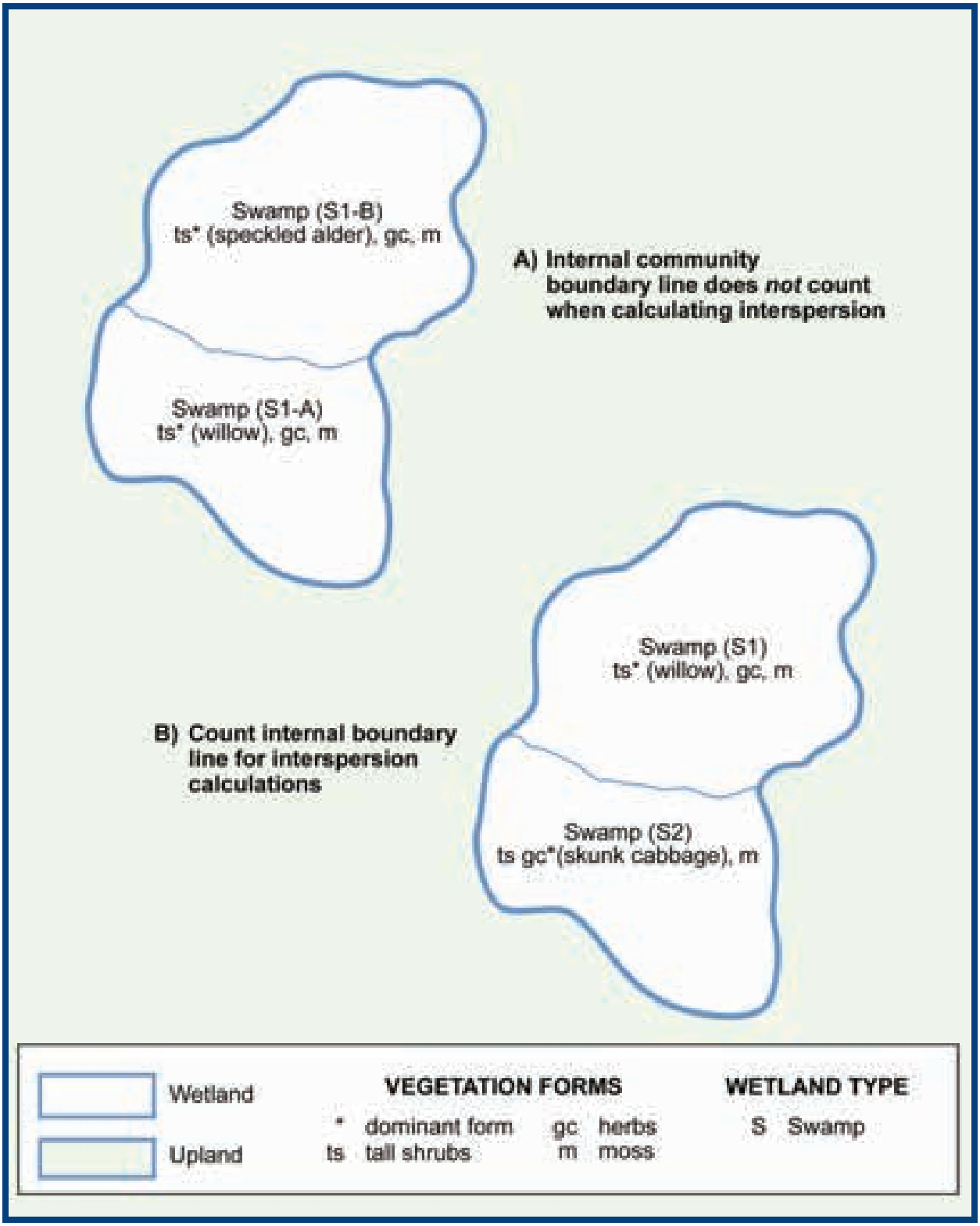


Figure 13: Example of how to use internal vegetation boundaries to score diversity of forms and interspersion. A) The two swamp communities illustrated are dominated by ts and are considered the same for purposes of scoring diversity of forms and interspersion. B) The two swamp communities, one dominated by ts and one dominated by gc, are considered separate communities when scoring diversity of forms and interspersion. Refer to Sections 1.2.2 and 1.2.5 in text for details.

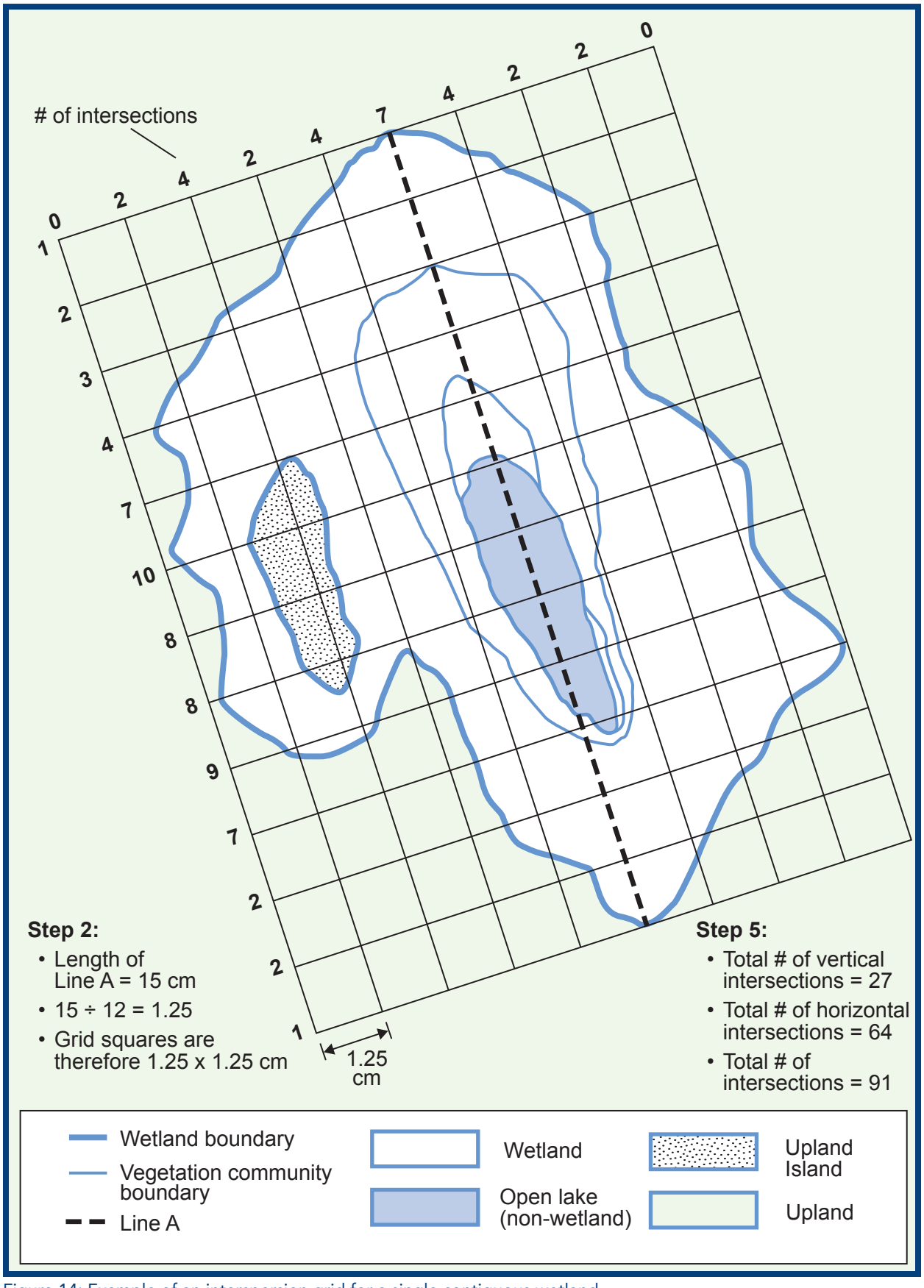


Figure 14: Example of an interspersion grid for a single contiguous wetland.

Photo: MNR-2007 Canada-Ontario Agreement

1.2.6 Open Water Types

This attribute addresses the value of **permanently flooded areas** to the overall habitat diversity and quality within a wetland. The relative proportion and areal configuration of permanent open water to adjacent emergent vegetation is extremely important to many species of wildlife. For example, many species of waterfowl use islands and complex meandering shorelines for nesting, feeding and resting. Likewise, frogs prefer wetlands with numerous embayments. A cover-to-water ratio approaching 1:1 is optimum for waterfowl (Golet 1976) and wetlands approaching this ratio may also be extremely important as fish nursery areas.

Areas of permanent open water are normally found in marshes and sometimes in open portions of bogs or fens. Open water in permanently flooded swamps is also considered. When assessing open water, do not consider areas where the vegetation density is so high that a duck could not swim there.

The percentage of permanent open water should be assessed for each vegetation community during the field mapping of the wetland. Using the field observations and the wetland vegetation map, **the evaluator should assess both the *percentage* and *pattern* of permanent open water in the entire wetland.** The eight open water types are illustrated and described in Figure 15.

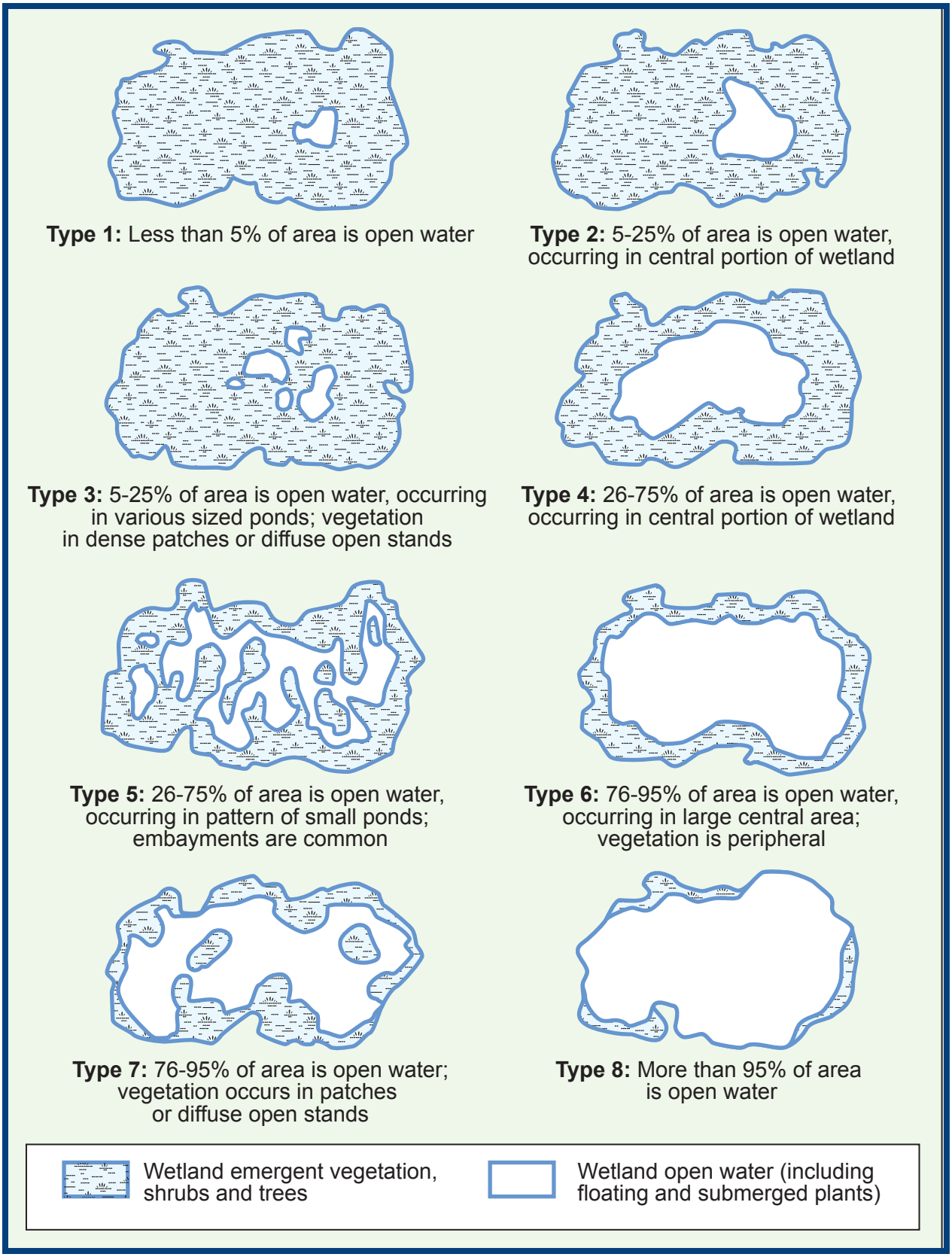


Figure 15: Wetland open water types described in Section 1.2.6.
Diagrams should not be used in isolation of the text. Adapted from Golet, 1976.

Calculating Open Water Estimates

Mean % of open water is calculated from the low and high estimates recorded for each community in the field. This mean % is then converted directly into the area (ha) of open water for each community, i.e. a 100ha swamp community with a mean of 15% open water has 15 ha of open water. Converting % open water to hectares of open water is necessary because it is not possible to simply add the estimated percentage of open water for communities which are of unequal area. By totalling the area of open water calculated for each individual community, one can then determine the total area of open water for the wetland and then the percent of open water for the entire wetland (i.e., [area of open water/wetland size] x 100). Table 3 provides an example of how to estimate mean percent open water.

Table 3: Record of Open Water Estimates

Community Code		Vegetation Community Area	Open Water			
Field	Final (Map)		High est. %	Low est. %	Mean %	Area (ha)
1	M1	5.94				
2	M2	10.18	30	20	25	2.55
3	W3	33.98	80	75	78	26.50
4	S1	5.73				
5	S2	9.29	15	10	12	1.11

Results for Table 3 indicate that the total wetland size is 65.12 ha, of which 30.16 are open water communities. Thus, 46% of the wetland is open water.

NOTE: The "field community number" is for the rough community number, e.g. 1, 2, 3, etc. from the field note book.

EVALUATION:

Permanent open water:

1. Type 1 = 8
2. Type 2 = 8
3. Type 3 = 14
4. Type 4 = 20
5. Type 5 = 30
6. Type 6 = 8
7. Type 7 = 14
8. Type 8 = 3
9. No open water = 0 points

*(*Score one only, *maximum score 30 points)*

1.3 SIZE (BIOLOGICAL COMPONENT)

In this evaluation system larger wetlands generally receive higher scores since the larger a wetland the more likely it will contain various valued features. The score given to a wetland for its size is linked to biodiversity. Thus, a large wetland made up of only cattail mats is considered to be much less valuable than another of the same size which contains more than one wetland type, much interspersion and well distributed open water areas. The table which follows has been designed to correlate "size dependent" biodiversity values with size. The relation between size and the size-dependent biodiversity score is not linear; adjustments have been made in the table to ensure that large wetlands with low biodiversity do not receive an excessive number of points for size and also to ensure that small, high diversity wetlands receive high scores.

Biodiversity values to be used when determining the Size score are:

- 1.2.1 number of wetland types
- 1.2.2 vegetation communities
- 1.2.3 diversity of surrounding habitat
- 1.2.4 proximity to other wetlands
- 1.2.5 interspersion
- 1.2.6 open water

The total score earned by the above attributes are used, along with the wetland size, to determine the Size score (see Table 4).

Table 4: Evaluation Table for Size Score (Biological Component)

Wetland size (ha)	Total Score for Biodiversity Subcomponent									
	<37	37-47	48-60	61-72	73-84	85-96	97-108	109-120	121-132	>132
<20 ha	1	5	7	8	9	17	25	34	43	50
20-40	5	7	8	9	10	19	28	37	46	50
41-60	6	8	9	10	11	21	31	40	49	50
61-80	7	9	10	11	13	23	34	43	50	50
81-100	8	10	11	13	15	25	37	46	50	50
101-120	9	11	13	15	18	28	40	49	50	50
121-140	10	13	15	17	21	31	43	50	50	50
141-160	11	15	17	19	23	34	46	50	50	50
161-180	13	17	19	21	25	37	49	50	50	50
181-200	15	19	21	23	28	40	50	50	50	50
201-400	17	21	23	25	31	43	50	50	50	50
401-600	19	23	25	28	34	46	50	50	50	50
601-800	21	25	28	31	37	49	50	50	50	50
801-1000	23	28	31	34	40	50	50	50	50	50
1001-1200	25	31	34	37	43	50	50	50	50	50
1201-1400	28	34	37	40	46	50	50	50	50	50
1401-1600	31	37	40	43	49	50	50	50	50	50
1601-1800	34	40	43	46	50	50	50	50	50	50
1801-2000	37	43	47	49	50	50	50	50	50	50
>2000	40	46	50	50	50	50	50	50	50	50

2.0 SOCIAL COMPONENT

Photo: MNR-2007 Canada-Ontario Agreement

The social component attempts to evaluate the shorter term uses and amenities that wetlands provide to people. In other words, its main purpose is to measure some of the direct human uses of wetlands. However, human uses of wetlands recognized in the social component are very strongly dependent upon the continued existence of healthy ecological processes and ecosystems that function normally. Social values of wetlands are derived from information on economically valuable products, recreational activities, landscape aesthetics, education and public awareness, proximity to urban areas, ownership, and size.

2.1. ECONOMICALLY VALUABLE PRODUCTS

A number of plant and animal species found in northern wetlands may provide income and other necessities of life for people. Values included under this subcomponent must be wetland-dependent. Economically valuable products in a wetland ecosystem must be usable on a sustainable basis to be included in the scoring. Hence, gravel and sand deposits having value in road building and construction are not evaluated. Similarly, peat is not included because its extraction would seriously impact the ecological values of the wetland.

Sources of information on economically important products of wetlands are many and varied. Published literature, government records, local residents, and direct field observations can all play a role.

2.1.1 Wood Products

Trees, used for lumber, pulp, fencing and firewood, are obtained from northern wetlands. Treed conifer swamps of black spruce and hardwood swamps of black ash occur across notrthern Ontarion and can provide abundant wood products that can be commercially important. In more southern parts of the area of application of this evaluation manual one also finds red maple, eastern white cedar, elm, balsam poplar and yellow birch in wetlands.

The value of trees should be dependent on the quantity of timber harvestable on a sustainable basis. A 2 ha wetland that is 51% forested, and a 500 ha wetland that is 51% forested differ substantially in their relative economic value. The evaluation is therefore based upon the area of available wood.

All vegetation communities dominated by **live** trees (h or c) are considered to contain wood products. The percentage of the wetland that is dominated by these vegetation forms should be determined and translated into actual area (ha). This figure is then used to assess wood product availability.

On some public or private lands, harvesting may not be permitted. If timber harvest is not permitted, areas of the wetland that occur on such lands are not to be included in the total number of hectares of wetland vegetation communities dominated by live tree used to score this section.

EVALUATION:

Area Forested (ha); **not** wetland size

<5 ha	= 0 points
5 - 25	= 4
26 - 50	= 6
51 - 100	= 8
101 - 200	= 11
>200 ha	= 14

(maximum score 14 points)

2.1.2. Lowbush Cranberry

Lowbush cranberry (*Vaccinium macrocarpon* or *V. oxycoccus*) is restricted to bogs and sometimes fens. It is widespread in northern Ontario and sometimes harvested.

EVALUATION:

a) ___ a law/regulation prohibits harvesting of cranberry (0 points)"

b) Not as above:

Present = 2 points
Absent = 0

2.1.3 Wild Rice

Wild rice is of continuing importance as a source of income and local food. Stands of wild rice must be at least 0.5 hectares in size to be scored for this attribute. If two or more small stands of rice are present, their combined area must equal or be greater than 0.5 hectares in order to earn a score. **If wild rice occurs in public or private lands where harvesting is prohibited, this attribute scores 0 points.**

EVALUATION:

a) ___ A law/regulation prohibits harvesting of wild rice (0 points)

b) Not as above:

Present = 10 points
Absent = 0

River otter Photo: Simon Dodsworth

2.1.4 Commercial Baitfish

In northern Ontario, the sale of native baitfish is considered to be a very important economic activity in many areas as it is so closely linked with the sport fishery. In some areas baitfishing is not allowed. In these cases, this attribute scores 0 points. Scoring is based on whether fish are present or absent, not on whether or not baitfish licenses are held. Baitfish are defined under the Ontario Fishery Regulations.

EVALUATION:

a) ___ a law/regulation prohibits harvesting of baitfish (0 points)

b) Not as above:

Present = 12 points
Absent = 0

2.1.5 Furbearers

Wetlands provide essential habitat for furbearers. Only those mammals listed under the *Fish and Wildlife Conservation Act* can be scored under this section. A furbearer may inhabit or use the wetland either permanently or occasionally to be considered for this attribute. Some municipalities prohibit trapping in certain areas. If trapping is prohibited, this attribute scores 0 points. Evidence of presence of furberarers must be clearly documented in the WEDSR.

EVALUATION:

a) ___ Trapping is prohibited (0 points)

b) ___ Not as above:
For each furbearer species present, either permanently or from time to time = 3 points

(3 points for each species;
maximum score 12 points)

2.2 RECREATIONAL ACTIVITIES

NOTE: Visits to the wetland by educational groups are not to be scored under this section – see section 2.4 for information on scoring of educational visits.

Although wetlands may be used for a variety of recreational activities, **only those that are specifically dependent on the characteristics of the wetland itself are scored.** These activities are nature appreciation, hunting and fishing. Other activities may take place in or at the edge of wetlands. These include canoeing and boating, hiking, cross-country skiing and snowmobiling. However, these activities do not depend specifically on wetland characteristics and are not scored.

Information on wetland related recreational activities can be obtained from a number of sources including municipalities, Indigenous communities, conservation authorities, environmental non-government organizations, private hunting/fishing clubs that have lands in the wetland, landowners, publications, and through direct field observations. Evaluators must collect as much factual information on recreational uses as possible from all potential sources. **In all cases the recreational uses to be recorded are those that are known to occur. Personal views on potential uses should not be included.**

Criteria for Hunting:

Only activities that occur **in** the wetland can be scored (adjacent land use is not to be scored – i.e., using a marsh to access fishing opportunities in an adjacent lake or river is not to be scored). The score doesn't necessarily represent the number of animals caught – just the amount of time that users spend trying.

- High Intensity Use: : includes evidence of one or more of the following:
  - 100 or more hunter days of recreation by persons/groups
  - 10 or more hunting blinds or stands
  - managed public hunting areas
  - large facilities (e.g., offices, interpretive or resource centres) catering specifically to hunters using the wetland

- Moderate Intensity Use: includes evidence of one or more of the following:
  - 21-99 hunter days of recreation by persons/groups
  - 2-9 hunting blinds or stands
  - 2 or more hunt camps
  - promotion or recognition of the wetland on a recreational activities/opportunities map or website (specifically noting hunting possibilities in the wetland)
  - 5 or more clearly marked hunting trails

- Low Intensity Use: includes evidence of one or more of the following:
  - 1-20 hunter days of recreation
  - 1 hunting blind or stand
  - reported hunting use/activity by non-agency sources
  - any number of shotgun shells or arrows
  - 1-4 marked hunting trails

Photo: Rebecca Zeran

Criteria for Nature Appreciation/Ecosystem Study:

NOTE: Nature appreciation/ecosystem study includes activities such as birding, visiting to see displays of showy wildflowers or large trees, photography, or viewing within or along the edge of the wetland.

- High Intensity Use: A use can be considered to be of high intensity if the number of users has become so high or so concentrated that controls have had to be imposed on the activity. Commonly used control methods are limiting the number of users or having certain portions of the area off limits. Some examples are the establishment of sanctuaries or capping the number of tours that can go through a wilderness trail per day. Use by large concentrations of people requiring the provisions of facilities (i.e. washrooms, interpretation centres, etc.) is also considered to be high intensity. If numbers are available, then 100 or more recreation days.

- Moderate Intensity Use: A use is moderately intensive if it occurs on a regular basis but no special controls have been put on the number of users. Large-scale amenities are usually not present, although small outhouses or interpretive trails and signs may be present. If numbers are available, then 21-99 recreation days.

- Low Intensity Use: Low intensity uses are those that occur sporadically. Some examples are occasional visits by naturalists. If numbers are available, then up to 20 recreation days.

Criteria for Fishing:

NOTE: only use of the wetland for recreational fishing/angling is to be scored here – commercial fisheries are not included.

- High Intensity Use: includes evidence of one or more of the following:
  - 100 or more angler days of recreation by persons/groups
  - managed public fishing areas
  - facilities located in/adjacent to wetland, catering to angling enthusiasts
  - 10 or more ice fishing huts

- Moderate Intensity Use: includes evidence of one or more of the following:
  - 21-99 angler days of recreation by persons/groups
  - 2-9 ice fishing huts
  - promotion or recognition of the wetland on a recreational activities/opportunities map or website (specifically noting angling possibilities in the wetland)

- Low Intensity Use: includes evidence of one or more of the following:
  - 1-20 angler days of recreation
  - 1 ice fishing hut
  - tackle, worm containers

EVALUATION:

Sources of information and reasons for scoring a wetland under high or moderate use below must be included in the data record.

Type of Wetland-Associated Use			
Intensity of Use	Hunting	Nature Appreciation/ Ecosystem Study	Fishing
High	40 points	40 points	40 points
Moderate	20	20	20
Low	8	8	8
Not Possible/ No evidence	0	0	0

(Score one level for each of the three wetland uses; scores are cumulative; *maximum score 80 points*)

2.3. LANDSCAPE AESTHETICS

Aesthetics, like all other wetland attributes, has a demonstrable worth to some segment of society. Beauty is an important ingredient in the lives of people, and the many forms of natural beauty are no exception. Only two aspects of wetland aesthetics are scored: distinctness and absence of human disturbance.

2.3.1 Distinctness

When a wetland is noticeably distinct within the surrounding landscape, it is considered to have more social value since it is generally more visible and recognizable. Indistinct wetlands are similar in vegetation form to their surrounding habitat, as for example, a silver maple-elm swamp next to a hard maple-white ash forest. The landscape context is an important consideration for the distinction score, and the aerial photo perspective is one of the key ways to assess landscape context. If, on an aerial photograph, a wetland is difficult to distinguish from adjacent upland, it should be scored as indistinct.

Examples of **clearly distinct wetlands** would be those in agricultural or urban settings where they contrast sharply with the surrounding uplands. However, clearly distinct wetlands are not limited to those in agricultural or urban settings.

Distinctness is scored based on the professional judgement of a trained wetland evaluator (i.e., someone familiar with wetland site types and communities). This attribute should not be scored based on how society at large might view the wetland.

EVALUATION:

Clearly distinct = 3 points
Indistinct = 0

(maximum score 3 points)

2.3.2 Absence of Human Disturbance

The naturalness or lack of human disturbance of a wetland is generally considered as a value to many people. Natural qualities are greatest when there is little or no obvious human influence. In essence, this attribute provides some measure of the obvious beauty of some wetlands that results from the appearance of an entire view of it as a complex three-dimensional natural ecosystem from which people may receive much satisfaction and pleasure.

Human impacts on wetlands are many and varied with respect to their scope, intensity and duration. Activities and items to consider include roads, utility corridors, buildings, dumps, fill, channelization, dredging, drainage ditches, control dams and other human uses. In one form or another all of these activities have impacts and are in fact "conversions to other uses". But since the disturbance is to specific portions of the wetland it still retains much of its ecosystem integrity and is still a functional wetland. It is up to the evaluator to judge whether infringements upon the wetland at its edge are to be considered as disturbances or whether they are to be ruled out of the wetland. However, ditches beside a wetland which drain the wetland are considered to be disturbance.

Polluted water is considered to be a form of human disturbance. Things to be noted include algal blooms, foul odours, and turbidity. This does not include a stagnant swamp that is free from human disturbance, even though it may have a noxious odour.

The areal extent of disturbances should be estimated, so that localized situations can be separated from more widespread disturbances.

EVALUATION:

Human disturbances absent or nearly so = 7 points

One or several localized disturbances = 4

Moderate disturbance; localized water pollution = 2

Wetland intact but impairment of ecosystem quality intense in some areas = 1

Extreme ecological degradation, or water pollution severe and widespread = 0

*(*Score one only, *maximum score 7 points)*

2.4 EDUCATION AND PUBLIC AWARENESS

Identified wetland values to be scored here include the use of wetlands by school groups for educational exercises or observations, the use of wetlands for research, and also the existence of facilities for the interpretation of nature and the environment. **It is not the potential** for any of these activities that is to be determined, but rather the actual current status of each activity.

2.4.1 Educational Uses

The greater the amount of use by educational groups, the more valuable a wetland is. To determine the amount of use of an area by organized school groups or for other **formal** educational processes, the evaluator must contact school boards, universities, colleges, school principals and/or biology teachers. The reason for visiting the wetland must be part of the curriculum (e.g., study wetland flora, field trip to study wetland wildlife, etc.).

NOTE: Visits by naturalists clubs are **not to be** scored in this section (see section 2.2).

Criteria for scoring educational uses:

- Frequent: An average of two or more visits per year by one or more school groups for the purpose of studying the animals, plants and/or ecosystems, etc.
- Infrequent: An average of one or fewer visits per year by organized school groups
- No visits: No records available on visits by organized school groups.

EVALUATION:

Frequent	= 20 points
Infrequent	= 12
No visits	= 0

(Score highest appropriate category; *maximum score 20 points*)

2.4.2 Facilities and Programs

A wetland that has specific buildings, trails, and literature, or has programs to interpret the flora, fauna and ecology of the wetland, has more social value than a wetland lacking such facilities or programs. An interpretation centre has a resource person who acts as an interpreter for groups or for the general public. An interpretation shelter would have a series of displays which are self-explanatory. Unless nature trails have signs or brochures which explain natural features, they cannot be considered to be interpretive trails.

EVALUATION:

Staffed interpretation centre with shelters, trails, literature	= 8 points
No interpretation centre or staff, but a system of self-guiding trails and observation points or brochures available	= 4
Facilities such as maintained paths (e.g., wood chips) boardwalks, boat launches, or observation towers but no brochures or other interpretation	= 2
No facilities or programs	= 0

(Score first appropriate category, *maximum score 8 points*)

2.4.3 Research and Studies

Over the years, scientists and others have made use of certain wetlands to further the objectives of science, community planning and management. Wetlands used in this manner are considered to have enhanced social value.

When reviewing the background information on the wetland, check reports and contact government offices and any other local potential sources (e.g., colleges and universities) to determine whether any scientific research has been published. Popular articles and unpublished government reports relating to the wetland environment can be acquired from a variety of sources. Information on wetlands may be found in ANSI reports, Environmentally Sensitive Areas Reports, deer yard assessments, Ontario Geological Survey Peatland Inventories or other government of non-governmental organization reports. In addition, local naturalists club publications often carry articles regarding wetland areas and their significant flora and fauna.

The criterion for "long term research" is that a university or government research group or individual has conducted research in the wetland for at least five years and published the results, although the research may no longer be taking place. Refereed papers include those published in recognized scientific journals as well as post-graduate theses.

Environmental assessments or environmental impact reports do not qualify for scoring under this attribute. They are to be listed in the data record but not scored. Likewise, previous evaluations of the wetland are not considered to be "reports" as required for the application of this attribute. However, **information** in these reports may be used to assess other attributes in the evaluation, such as Special Features.

NOTE: include complete references for all publications scored in this section.

EVALUATION:

Long term research has been done	= 12 points
Research papers published in a refereed scientific journal or as a thesis.	= 10
One or more (non-research) reports have been written on some aspect of the wetland's flora, fauna, hydrology, etc.	= 5
No reports known	= 0

(Score all that apply, *maximum score 12 points*)

2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT

When a wetland is located in or near an urban area, subdivision, small town, or cottage development, it can be identified, viewed and visited by more people. The fostering of appreciation for, and an understanding of the ecological functions of such wetlands and their wildlife may facilitate the recognition and continued existence of wetland ecosystems. **It is the actual edge of settlements (i.e. not city or town limit lines) that is to be determined. Distances to the wetland should be measured by well-travelled roads.**

EVALUATION:

Circle only the highest score applicable

		population >10,000	population 2,500-10,000	population <2,500 or cottage community
Distance of wetland to settlement	within or adjoining settlement	40 points	26 points	16 points
	0.5 to 10 km from settlement	26	16	10
	10 to 60 km from settlement	12	8	4
	60-100 km from nearest settlement	5	2	0
	>100 km from settlement	0	0	0

(Score highest applicable category, *maximum score 40 points*)

2.6 OWNERSHIP

The ownership of a wetland may have a bearing on its value to society. More people are likely to benefit from the values of a wetland if it is in some form of public ownership. Most Counties and Regional Municipalities have maps outlining areas of public and private land. Various online tools and databases also exists that may provide such information.

Whether public or private, wetlands that are legally protected **as wetlands** are considered to have more value than other wetlands. Examples of legal protection include fixed-term (10-30 year) conservation agreements held by agencies such as Ducks Unlimited Canada, or wetlands protected by a legally binding conservation easement. In addition, the ecological integrity of wetlands occurring in provincial or national parks or protected areas is ensured through legal regulation of the land. Wetlands under a voluntary stewardship agreement or those participating under the Conservation Land Tax Incentive Program (CLTIP) do not receive extra points here because there is no binding requirement for continued wetland protection.

Determine the percentage of public and private land contained in the wetland.

EVALUATION: (FA = Fractional Area)

Land held by or held under a legal contract by a conservation body (as defined by the *Conservation Land Act*) for wetland protection	FA x 10
Wetlands occurring in provincially or nationally protected areas (e.g., parks and conservation reserves)	FA x 10
Not as above: Crown/Public land	FA x 8
Private land	FA x 4

(*maximum score 10 points*)

2.7 SIZE (SOCIAL COMPONENT)

Photo: MNR-2007 Canada-Ontario Agreement

The size of a wetland is a factor in determining its overall social value. However, certain social values appear to be irrelevant to size - as for example ownership and educational use. Therefore the approach taken in evaluating size is to correlate size with those social values which are strongly size dependent. Those included are resource products with cash value, recreational activities and proximity to urban areas. Further, the relationship between size-dependent social values and size is not considered to be linear since in certain circumstances smaller wetlands are more valuable socially than larger ones.

Table 5 is used to evaluate size. Size dependent social features are:

2.1 Economically valuable products
2.2 Recreational activities
2.5 Proximity to areas of human settlement

The total score for these attributes and the wetland size are used to determine a score for Size.

Table 5. Evaluation Table for Size Score (Social Component)

Total for Size Dependent Social Features

Wetland Size (ha)	<31	31-45	46-60	61-75	76-90	91-105	106-120	121-135	136-150	>150
<5 ha	1	2	4	8	12	13	14	14	15	16
5-8	2	2	5	9	13	14	15	15	16	16
9-12	3	3	6	10	14	15	15	16	17	17
13-17	3	4	7	10	14	15	16	16	17	17
18-28	4	5	8	11	15	16	16	17	17	18
29-37	5	7	10	13	16	17	18	18	19	19
38-49	5	7	10	13	16	17	18	18	19	20
50-62	5	8	11	14	17	17	18	19	20	20
63-81	5	8	11	15	17	18	19	20	20	20
82-105	6	9	11	15	18	18	19	20	20	20
106-137	6	9	12	16	18	19	20	20	20	20
138-178	6	9	13	16	18	19	20	20	20	20
179-233	6	9	13	16	18	20	20	20	20	20
234-302	7	9	13	16	18	20	20	20	20	20
303-393	7	9	14	17	18	20	20	20	20	20
394-511	7	10	14	17	18	20	20	20	20	20
512-665	7	10	14	17	18	20	20	20	20	20
666-863	7	10	14	17	19	20	20	20	20	20
864-1123	8	12	15	17	19	20	20	20	20	20
1124-1460	8	12	15	17	19	20	20	20	20	20
1461-1898	8	13	15	18	19	20	20	20	20	20
1899-2467	8	14	16	18	20	20	20	20	20	20
>2467	8	14	16	18	20	20	20	20	20	20

2.8 ABORIGINAL VALUES AND CULTURAL HERITAGE

The significance of the wetland for both Aboriginal Values and Cultural Heritage must be investigated and may score "**bonus points**". Although either category may score 30 points, the total score possible for this section is **capped at 30 points**.

2.8.1 Aboriginal Values

While the values outlined in the Social Component apply to all of the people of Ontario, the Aboriginal Values subcomponent recognizes additional significance of a wetland to aboriginal people. This significance may be related to wetland products derived from, for example, fishing, trapping, wild rice and other plant harvesting, or may result from cultural and spiritual values.

Ministry of Natural Resources aboriginal liaison staff may be able to supply information for this subcomponent. If the wetland is of significance to aboriginal people, a **bonus** score is given. If no information is available or no reply is received from the band, no score is assigned.

Full documentation of sources must be attached to the data record.

EVALUATION:

Significant	= 30 points
Not Significant	= 0
Not known	= 0

(maximum score 30 points)

2.8.2 Cultural Heritage

Some wetlands may have cultural heritage value or interest. This may stem from some noteworthy historic event that transpired in or at the edge of a wetland or because there is evidence of physical change brought about by humans. Included would be archaeological sites, historic portages, log chutes, burial sites, historical fishing ports, famous hunt clubs, etc. Existing guidelines defining cultural heritage resources should be consulted before assessing this attribute – for example:

1. *Forest Management Guide for Cultural Heritage Values, OMNR 2007*

2. *Technical Guideline for Cultural Heritage Resources for Projects Planned under the Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects and the Class Environmental Assessment for Provincial Parks and Conservation Reserves, 2006*

3. *Ministry of Tourism and Culture Standards & Guidelines for Conservation of Provincial Heritage Properties, 2010)*

For purposes of this evaluation, there must be a physical structure, artifact or remains of cultural heritage value or interest within the wetland boundary or a historic person of cultural heritage value or interest associated with the wetland. The information required to assess this subcomponent **must** be fully documented and accepted by MNR staff. If a wetland is of cultural heritage value or interest, a **bonus** score is given:

EVALUATION:

Significant	= 30 points
Not Significant	= 0
Not known	= 0

(maximum score 30 points)

3.0 HYDROLOGICAL COMPONENT

Photo: Wasyl Bakowsky

Wetlands can only exist where the water table is at or above the mineral soil surface for a significant portion of the year. In the case of non-lacustrine wetlands, there are three ways that wetlands remain saturated (Roulet 1990a): the retention of water from rain or snow due to poor drainage (Bay 1969); spring and fall input of groundwater (Whiteley and Irwin 1986); or a constant input of groundwater throughout the year (Roulet 1990b). Saturation of lacustrine or riverine wetlands is maintained by the water level of the adjacent lake or river (Gosselink and Turner 1978). The abundance of water in wetlands is maintained by very low gradients (e.g., Hudson Bay Lowland), low permeability of the substrate (e.g., Clay Belt), flow convergence caused by topography (widely occurring swamps, fens and marshes), and from adjacent aquatic ecosystems (e.g., riparian and shoreline marshes). Wetlands, thus, are integrally connected to the surrounding environment and must be considered in the context of the basin which controls their water sources.

The hydrological factors that are critical to the maintenance of a wetland are not evaluated explicitly in any component of this evaluation system. Rather, the link between hydrological and other functions of a wetland is recognized implicitly in the scoring of productivity and biodiversity in the biological component and in some attributes of the social and special features components. However, it must be recognized that many of the non-hydrological functions of a wetland depend, in part, on the wetland's hydrological setting and that changes in the basin beyond the boundaries of the wetland could have an effect on the ecological value of the wetland.

The hydrological component of this evaluation system assesses the role a wetland plays in the maintenance, control, and/or modification of the quantity and quality of water passing through a drainage basin. The hydrological component is designed to determine the net hydrological benefit provided by the wetland to the portion of the basin downstream of the wetland.

There has been, and still is, much debate over the hydrological functions of wetlands (Carter *et al.* 1978). However, much of the debate is a result of trying to attribute hydrological generalities across all wetlands. It has long been recognized that hydrology varies greatly with wetland type. For example, bogs receive all input of water from the atmosphere (Bay 1969), while fens (Siegel and Glasser 1987) and some swamps (Roulet 1990b) receive considerable groundwater inputs as well as rain. Evapotranspiration from swamps and treed bogs is controlled by the conduction of water through the tree canopy, while evapotranspiration from fens and marshes is controlled by graminoid plants (Carter 1986). Evaporation from treeless bogs dominated by *Sphagnum* mosses is limited by the non-vascular canopy (Price 1991).

Bogs, fens, swamps, and marshes have very different combinations of peat and mineral soils which affect the water table/storage-capacity relationships differently (Verry 1988). With large hydrological differences among wetland types, one cannot assume all wetlands serve the same hydrological function. To assess the hydrological function of a wetland, it must be evaluated relative to its role in the drainage basin where it occurs and its hydrological setting in that drainage basin.

Special Considerations for Evaluating Northern Ontario Wetlands

Northern wetlands occur in three situations: (1) landscape wetlands where they are the primary and many times the only surface hydrological feature of the basin and exchange water primarily with the atmosphere; (2) basin wetlands where they occupy some portion of the basin and exchange water between both the adjacent terrestrial ecosystems and the atmosphere, and (3) in-stream, near-stream and lake wetlands where the wetland exists because of the water exchange with the adjacent aquatic ecosystem.

The hydrological component of the evaluation system for wetlands in southern Ontario recognizes primarily those hydrological functions which serve human utility values. Thus, southern Ontario wetlands receive high scores when they ameliorate the downstream water flow and quality to suit the requirements of the people living there. In northern Ontario, the hydrological function of a wetland may serve little direct human benefit, but it is typically more important to the ecological function of the wetland itself, as well as to the natural environment downstream. Thus the northern Ontario wetland evaluation explicitly recognizes the importance of hydrology in the development and maintenance of wetland ecosystems. The evaluation considers the link between upslope water sources and the wetland itself as well as the effect of the wetland on the downstream ecosystems.

The source of water in a wetland controls (1) the magnitude and variability of water storage, and (2) the availability of nutrients. Together, these determine the ecological function of the wetland. For example, in the north, many wetlands have a very small, usually seasonal, groundwater input. While this input may be insignificant to the water budget, it provides essential nutrients which allow a more diversified plant community to develop. Therefore, the link between the upland portion of the basin, which controls the groundwater and surface water links to the wetland, must be considered to account for the ecological significance of hydrology.

The evaluation of hydrology is divided into six subcomponents: (1) flood attenuation, (2) groundwater recharge, (3) downstream water quality improvement, (4) carbon sink, (5) shoreline erosion control and (6) groundwater discharge. The rationale for the inclusion of each function is discussed in the introduction to the subcomponents of this section.

3.1 FLOOD ATTENUATION

The reduction of flood peaks in areas downstream of wetlands is an important ecological function, as well as an obvious human value function. The ecological benefits include protection of downstream riparian areas from erosion and sedimentation, and from washout or siltation of spawning beds.

Wetlands can reduce storm floods both by temporarily holding back water that would otherwise run downstream and, in the longer term, by allowing water to seep into groundwater or to be taken up and released by plants through evapotranspiration (Price 1992). The ability of wetlands to provide short-term, temporary, storage of water is important for reducing flood peaks. Wetlands have significant micro-relief (Ivanov 1981) which allows temporary storage of water in depressions and increases surface resistance to overland flow (Kadlec *et al.* 1981). In addition, when a wetland is in a riverine location, it provides an area for flood water to go (Carter 1986). When riverine wetlands and lakes make up between 5% and 20% of a basin, they can reduce flood peak rates by up to 75% (Verry 1988). These factors decrease the peak flow by extending the storm flow recession limb (the exponential decrease in streamflow that occurs after the rain has ceased), while not significantly reducing the amount of water that eventually runs off.

Wetlands have commonly been perceived to act as sponges that can store large amounts of incoming water (Bertulli 1981), but the results of field studies (e.g., Bay 1969; Carter 1986; Roulet 1990a; Price and Woo 1988; Woo and Valverde 1981) clearly demonstrate that most wetlands have little available capacity for storage. Available storage capacity depends on the location of the water table (Verry *et al.* 1988). In most wetlands the water table is at or near the soil surface. Therefore, unless the rainfall is preceded by a long dry period, the wetland can provide little additional storage to attenuate flow (Bay 1969).

Patterned wetlands, common in northern Ontario, are an exception to the above. The huge storage capacity caused by the ridge-pool microtopography allows extensive and prolonged storage. This stored water is eventually lost to evapotranspiration and groundwater recharge (Price *et al.*1990).

Isolated wetlands, because they have no surface outflow, are 100% efficient for attenuating flood crests. The removal of such detention areas would aggravate flooding downstream. Thus, isolated wetlands receive the maximum score for flood attenuation.

Lacustrine wetlands on smaller lakes may provide detention storage if they are large relative to the lake in which they are located. Lacustrine wetlands located on major lakes, and riverine wetlands along major rivers provide no flood attenuation since the storage capacity of the wetland is very small relative to that of the lake or river (See Figure 18). Other riverine and palustrine wetlands receive scores between zero and the maximum based upon their effectiveness in attenuating flood peaks, as measured by their size and location in the drainage basin.

The scoring method for flood attenuation uses a step wise process. The steps involve identifying the maximum attenuation that could be obtained from the wetland function based on its site type, and then determining the effectiveness of the wetland in providing flood attenuation based on relationships among wetland size, extent of upstream detention, watershed size and surface form of the wetland.

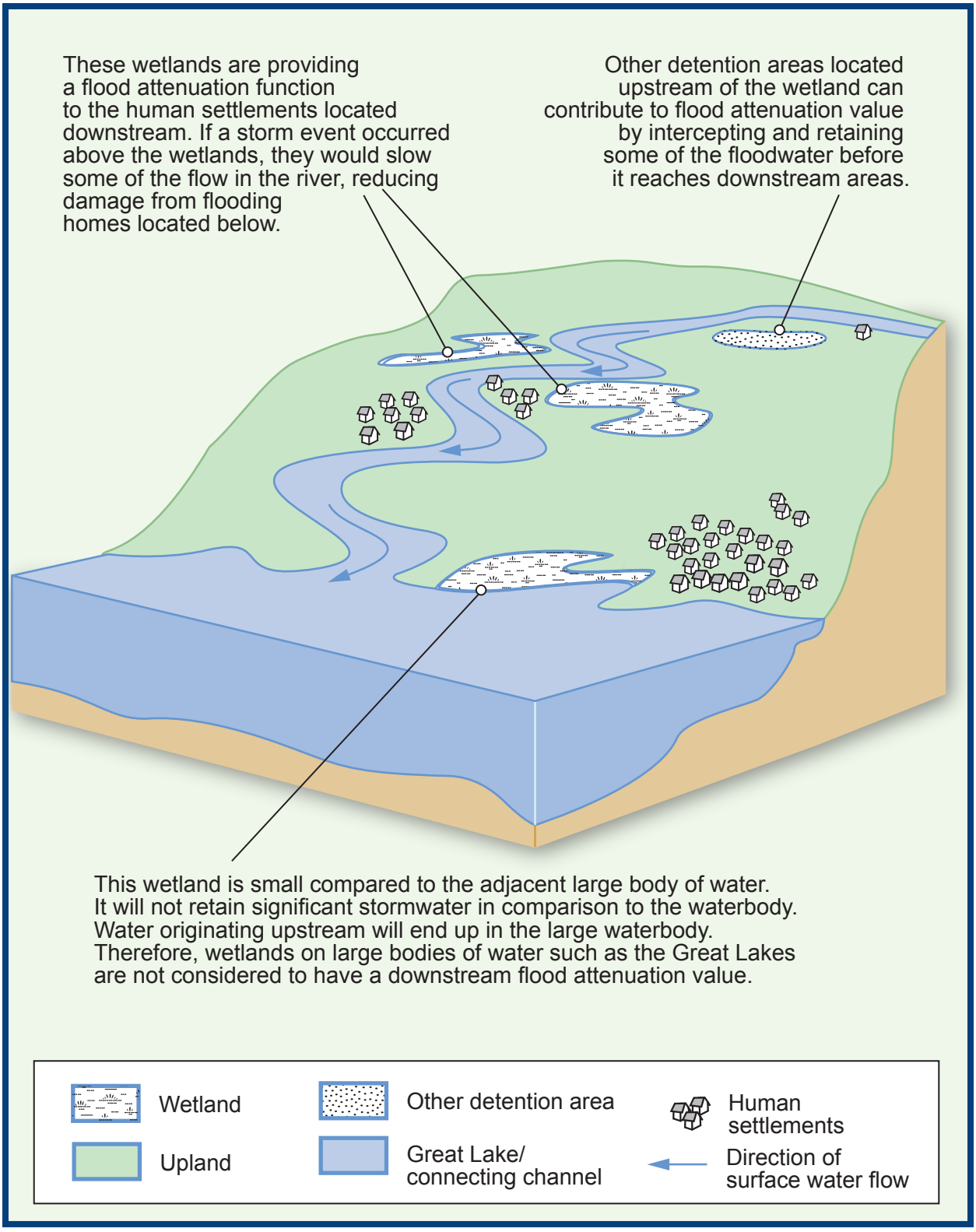


Figure 16: Graphic showing wetlands with and without flood attenuation value under the OWES.

Upstream Detention

Upstream detention is used to consider the net benefit derived from the wetland being evaluated relative to other detention areas in the watershed upstream of the wetland. The rationale for evaluating upstream detention is that if a significant amount of detention is already available upstream, the net benefit of the wetland for flood attenuation would be reduced. However, if other wetlands are removed from that watershed due to development, the hydrological value of wetlands downstream becomes more significant and justifiably such wetlands should be re-evaluated.

If a wetland represents 50% of total storage or more in its basin (based on area), it will provide maximum detention benefits. Figure 17, based on Adamus and Stockwell (1983), portrays this relationship:

It is essential for the evaluator to identify all detention areas in the basin, and not only those directly in the path of inflowing streams. The other detention areas could be open water areas (lakes, large rivers, reservoirs, ponds, flooded pits or quarries) or other wetlands, including isolated wetlands which have a retention function because they contribute no flow downstream. Detention areas can be identified using 1:10,000 OBM mapping (preferred) or 1:50,000 NTS maps.

Detention areas for any basin need to be identified and measured only once. Upstream detention area can then be calculated for each wetland as it is evaluated. The upstream detention factor is calculated by dividing the area of the wetland being evaluated by the total area of all *upstream* storage areas (including the area of the wetland being evaluated) and then multiplying by two.

For lacustrine wetlands, the lake is considered to be a detention area if lake water passes through a part of the wetland as it flows downstream (see Figure 18 A, B, C). If the lake is located downstream from (below) the wetland then the lake is *not* a detention area.

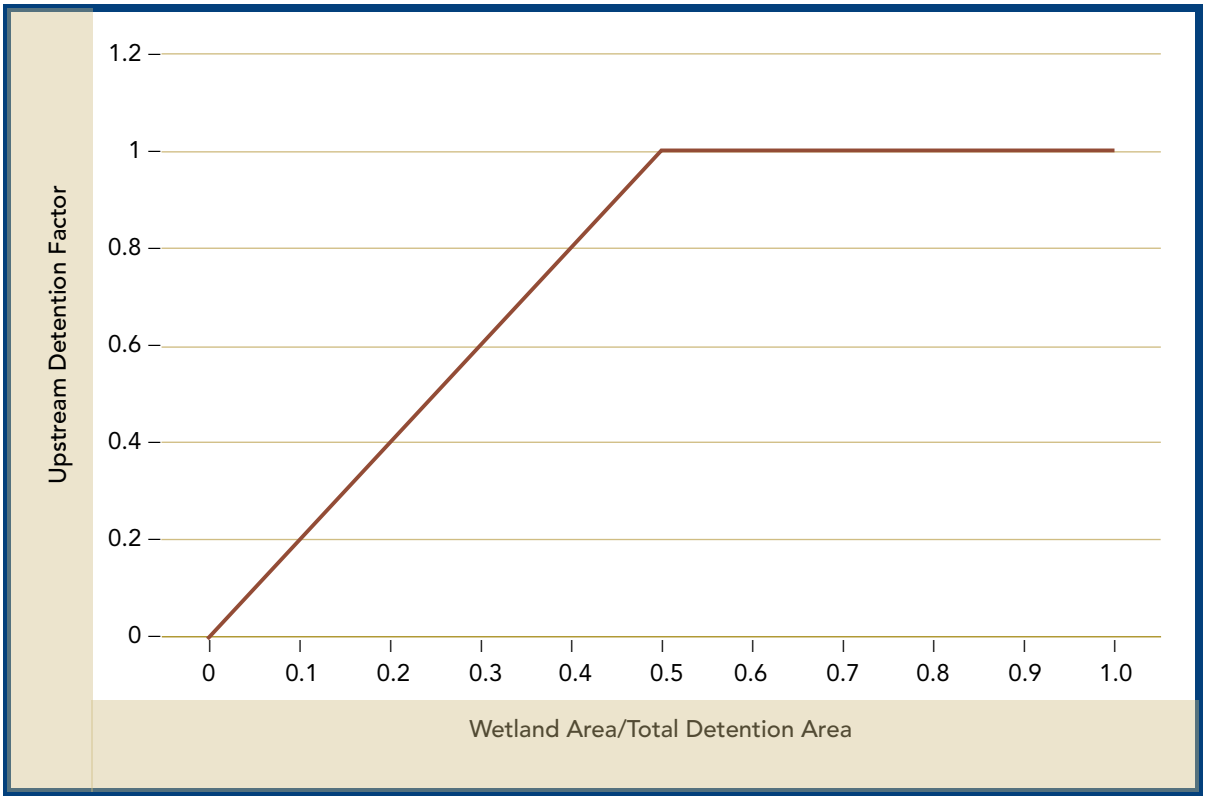


Figure 17: Relationship between upstream detention, wetland area and total detention area.

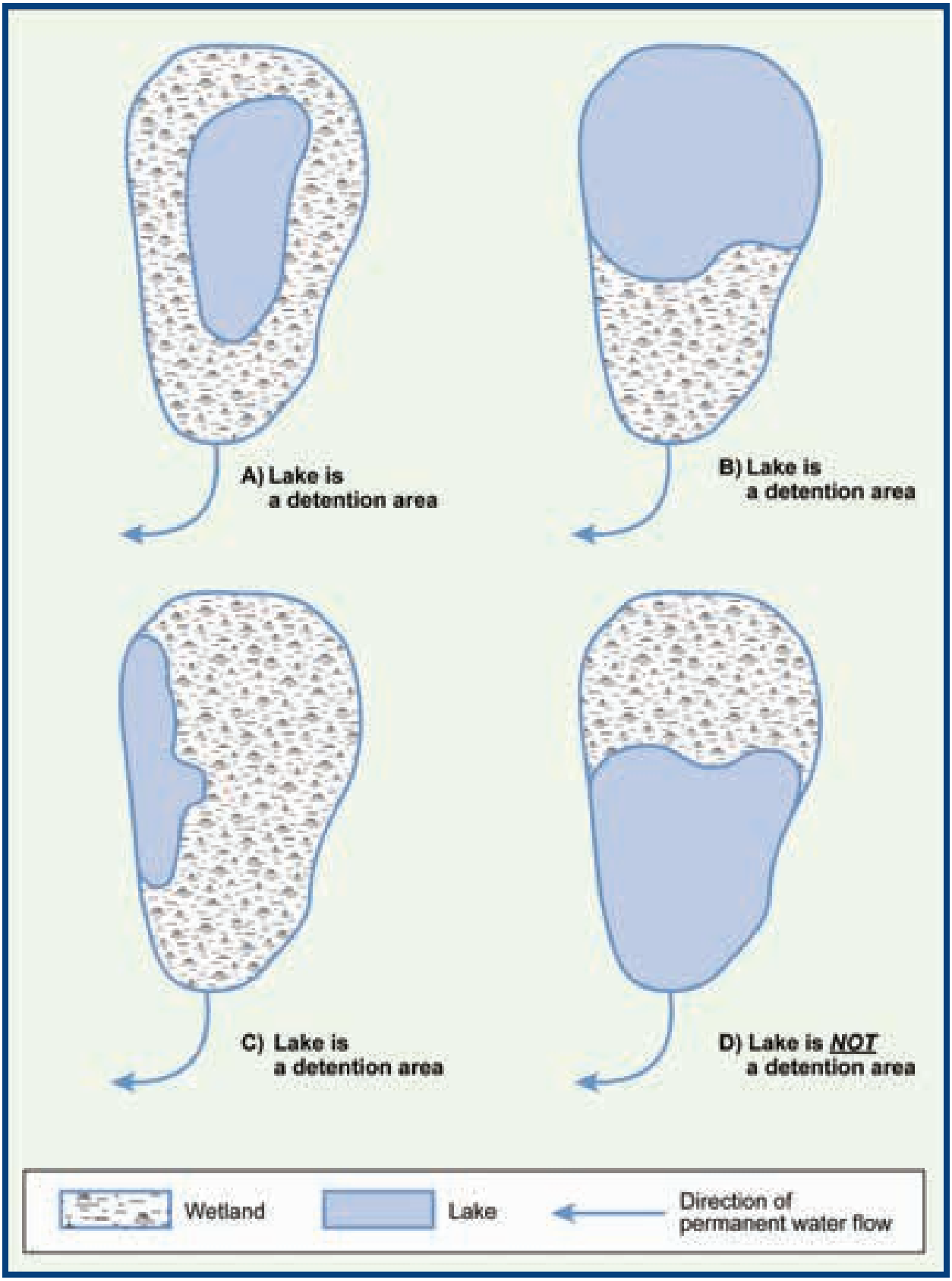


Figure 18: Determination of detention areas – lacustrine wetlands.

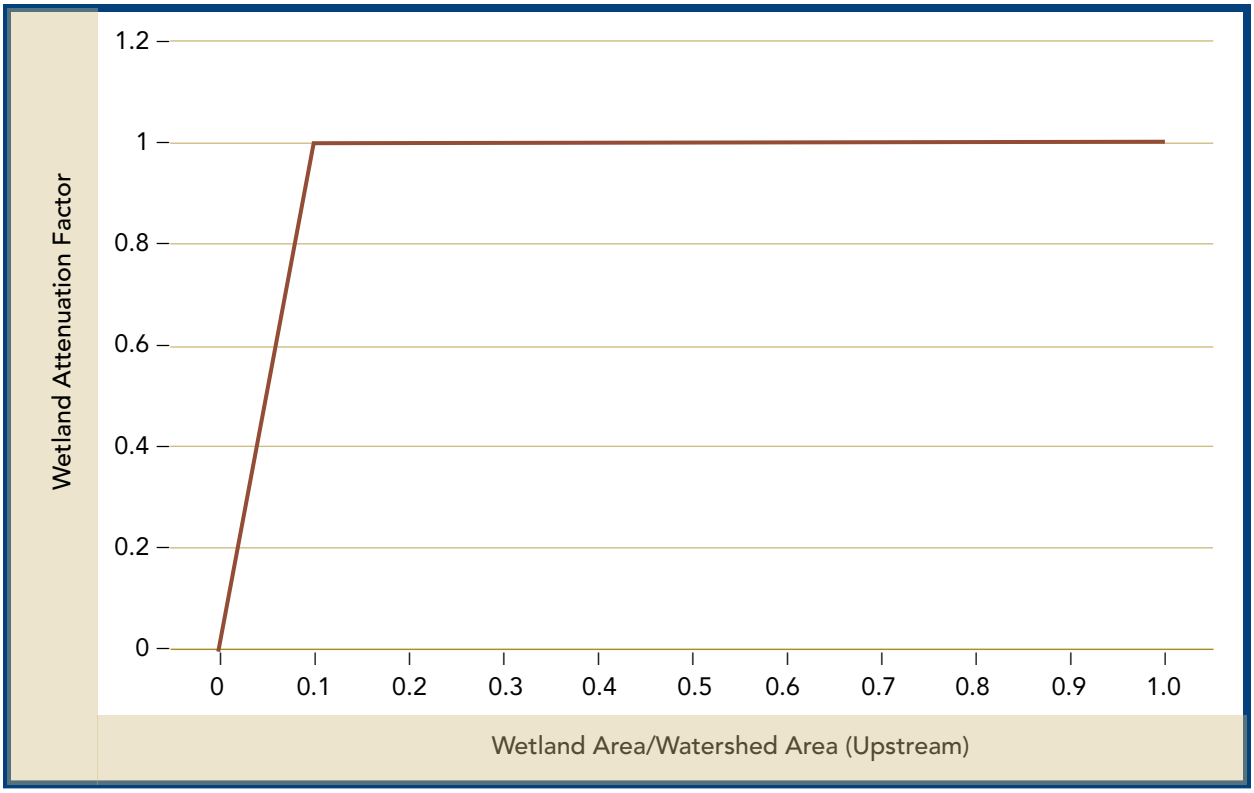


Figure 19: Relationship between wetland area, upstream watershed area and the ability of the wetland to attenuate flood peaks (wetland attenuation factor).

Wetland Attenuation

Wetland attenuation value is used to assess the efficiency of a wetland in attenuating flood peaks. Adamus and Stockwell (1983) note that the incremental gain in terms of flood attenuation is minimal when the size of the wetland exceeds 10% of the area of the watershed (see Figure 19). Wetlands comprising 10% or more (based on area) of the total storage in the basin, thus, receive maximum score. Smaller wetlands are pro-rated in a linear manner based on their size relative to the total detention area in the watershed.

Wetland attenuation is calculated by dividing the area of the wetland by the area of the catchment basin *upstream* and multiplying the result by 10. **For lacustrine wetlands, the upstream catchment is to be calculated as the catchment for the entire lake *minus* the area of the lake itself. Note that the entire water area, including areas <2m deep, is considered to be lake for this calculation.**

Surface Form

The ability of a wetland to detain water through microtopography depends on the surface form configuration. Wetlands which are normally flooded provide least resistance to surface flow (Price and Woo 1988). The presence of hummocks, and especially ridge-pool microtopography, can significantly increase resistance to flow, and thereby reduce runoff (Price *et al.* 1990).

EVALUATION (worked example; explanatory notes follow):

Check one of the following options:

____ If wetland is a *single coastal wetland*[1] ➡ **score 0 points** for this section.

____ If the wetland is entirely lacustrine and the ratio of wetland area to lake area is less than 0.1 ➡ **score 0 points** for this section.

____ If wetland or is entirely isolated in site type, **score 100 points automatically.**

_x_ Wetland not as above – proceed through steps **A through G** below.

(A) Total wetland area = 338 ha
(B) Size of wetland's catchment[2] = 4023 ha
(C) Size of other detention areas in catchment[3] = 141 ha

Wetland Surface Form (select the form which best describes the non-coastal units of the wetland):
___ flooded with little or no aquatic vegetation = 0
___ flooded but with submergent, emergent, or floating vegetation = 0.2
___ flat (lawn) vegetation (typical of fens) = 0.5
_x_ hummock-depression microtopography = 0.7
___ patterned (e.g. string bog, ribbed fen) = 1.0

(D) Wetland Surface Form Factor = 0.7 (maximum 1.0)
(E) Total area of upstream detention areas = {A + C} = 479 ha
(F) Upstream Detention Factor = {(A/E) x 2} = 1.0 (maximum 1.0)
(G) Attenuation Factor = {(A/B) x 10} = 0.84 (maximum 1.0)

NOTE: Evaluators need only enter in unique values for A through D; the remaining items (E through G) are simple formulas that use the entered values to calculate the final score.

Flood Attenuation Final Score = ([F + G + D] /3) x 100] = 84.67

Flood Attenuation Score *(maximum 100 pts)* 85

Explanatory Footnotes for scoring Flood Attenuation

1. For scoring this section, a 'coastal wetland' is a wetland located at least partially on (i.e., directly adjacent to) Lake Huron, Lake Superior, or the St. Mary's River.
2. For "inland" lacustrine wetlands, calculate the catchment for the lake and then subtract from this area the size of the lake as determined by the 'Ontario Base Map' boundary of the lake (including any wetlands in the lake that are considered within the boundary of lake on the OBM map).
3. For inland wetlands (i.e., wetlands not on a defined large lake or major river), only other detention areas within the wetland's catchment can be used. These "other detention areas" can be other wetlands, lakes, large rivers, reservoirs, ponds, flooded pits or quarries. For inland lacustrine wetlands the area of the lake, including other wetland areas directly associated with the lake that are not part of the wetland areas being evaluated, are not to be considered as an additional detention area unless the wetland area is located at the outflow of the lake.

3.2 GROUND WATER RECHARGE

With recent advances in the study of wetland-groundwater interactions it is now clear that only some wetlands recharge groundwater (Carter *et al.* 1978; Siegel 1988). Groundwater recharge through wetlands does not solely depend on the wetland, but is also a result of the topographic and geologic setting of the wetland.

A wetland is a groundwater recharge area if a component of groundwater flow is downward from the wetland to underlying soils (Siegel 1988). For wetlands that have very low permeability soils (clays) at their base, the only place that significant recharge can occur is at the perimeter of the wetland when it floods. For a wetland to provide a significant groundwater recharge function it requires a reasonably constant source of water such as from a stream (Woo and Valverde 1981) or surrounding slopes, and must be situated on permeable soils. See Figure 23 for a graphic representation of groundwater recharge vs. discharge.

Groundwater recharge through wetlands can provide both human utility functions as an important source of water for underlying aquifers, and also ecological functions if supporting springs located beyond the boundary of the wetland itself. Springs and streambank seepage areas often harbour regionally or provincially significant species. When such recharge wetlands are drained, such seepage areas or springs may be affected, together with the local ecosystems and species dependent upon them. Furthermore, the links between groundwater recharge and water quality improvement may also provide for more diverse ecosystems downstream.

While hydrogeological characteristics are difficult to measure, certain observations can suggest a recharge function. These involve understanding the wetland in the context of the basin, both surface and subsurface. While surface hydrology can be evaluated by general map analyses, subsurface flow components cannot because of the lack of specific local and regional information on the hydrological setting of most northern wetlands. Suitable data for making an assessment of recharge would usually require considerable expenditure of time by professional hydrologists.

In this evaluation, headwater wetlands (ones located high in drainage basins, on heights of land between different rivers, at the tops of escarpments, etc.) have the highest value for groundwater recharge. The evaluation also recognizes that because certain headwater wetlands do not discharge their water through outlet drains or streams, they reduce the "downstream" velocity of flow as well as the amount of erosion (Roulet 1989). Since water leaves the wetland downward through recharge, erosion of stream banks and beds, and associated downstream sedimentation cannot take place.

In summary, there are a wide range of both human utility and intrinsic ecosystem values associated with recharge functions of certain kinds of wetlands. It is not possible to measure these independently, and hence the following evaluations based upon site type and soils are provided.

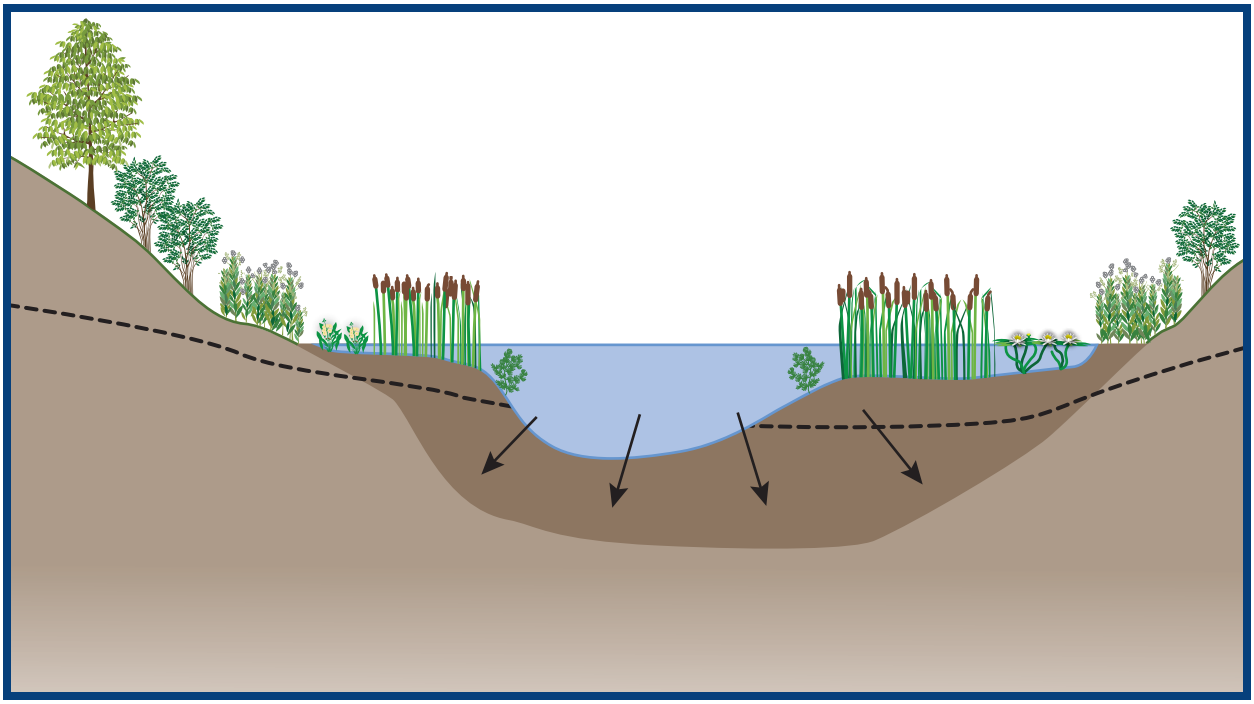


Figure 20a: Groundwater recharge. If the water level in a wetland is higher than the surrounding water table water flows out of the wetland. Wetlands often act as recharge areas in the summer. Modified from Mitsch and Gosselink (2000).

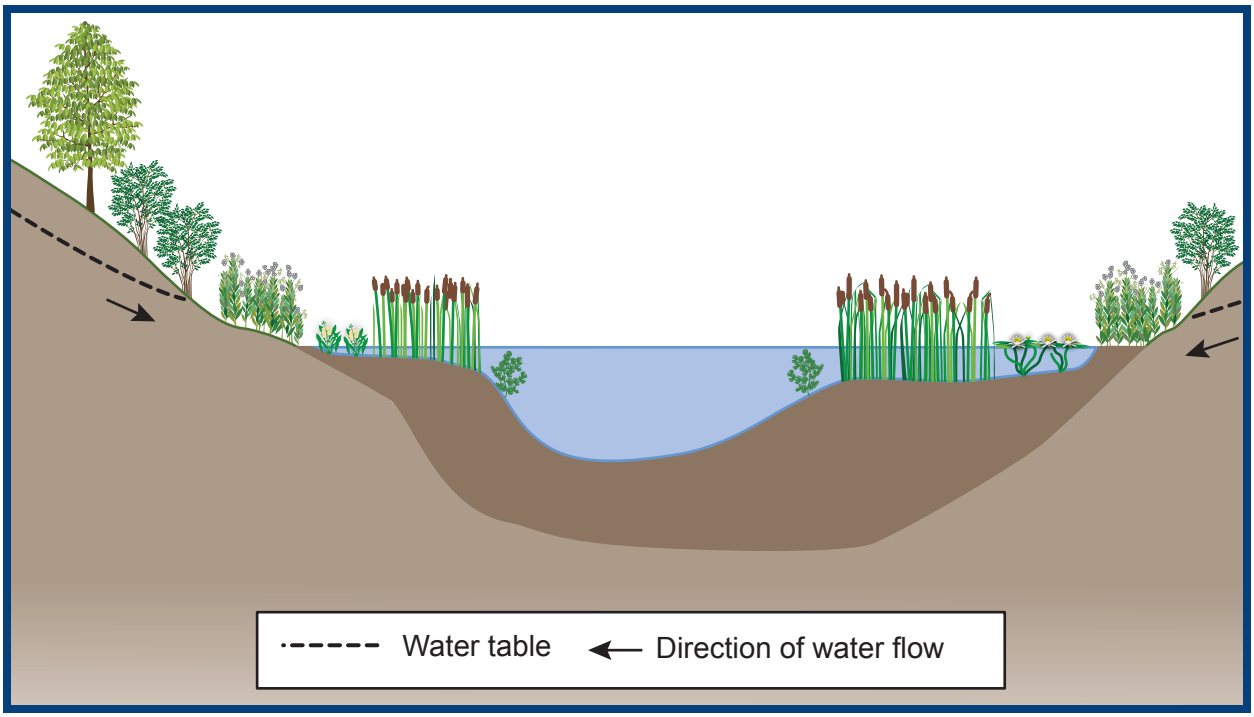


Figure 20b: Groundwater discharge. Water inflow from surrounding lands into a wetland occurs when the water level of a wetland is lower than the surrounding water table. Wetlands often act as discharge areas in the spring. Modified from Mitsch and Gosselink (2000).

3.2.1 Site Type

Isolated wetlands and many palustrine wetlands are a valuable source of groundwater recharge, and thus score high points for this function. Riverine wetlands recharge the groundwater only in special circumstances or for short times during flooding when recharge may take place at the margins of the wetland. Normally, riverine wetlands are groundwater discharge areas. The majority of lacustrine wetlands are located at the bottom of watersheds, and as a result, provide no recharge benefits. Those not located at the bottoms of watersheds also provide relatively little benefit, since the lake's seepage is likely to dominate the wetland's seepage. Lacustrine wetlands therefore receive a score of zero.

EVALUATION:

(a) Wetland > 50% lacustrine (by area) or located on the St. Mary's River Score = 0

(b) Wetland not as above. Calculate final score as follows:
(FA = area of site type/total area of wetland)

_____ FA of isolated or palustrine wetland x 20 = _____
_____ FA of riverine wetland x 5 = _____
_____ FA of lacustrine wetland (when wetland is <50% lacustrine) x 0 = _____

Photo: Regina Varrin

3.2.2 Soil Recharge Potential

An Ontario Ministry of Agriculture, Food and Rural Affairs soils mapping system, classifies soils into four groups (A, B, C, and D) according to water run-off and infiltration rates.

- Group A: soils have a low runoff potential and high infiltration rate; typically are sands and gravel.
- Group B: soils with moderate infiltration rates when completely wetted; sandy loam soils with moderately fine to moderately coarse textures.
- Group C: soils have slow infiltration rates when thoroughly wetted; typically silty-loam soils with an impeding layer or soils with moderately fine to fine texture.
- Group D: soils have a high runoff potential and very slow infiltration rate when thoroughly wetted; include clay soils with high swelling potential, soils in a permanent high water table and shallow soils over nearly impervious material.

Substrates are considered to be soils and other materials too shallow to be defined as soils per se. Substrates **adjacent** to the wetland can determine the wetland's efficiency in allowing the recharging of groundwater. Hydrologic substrates in Groups A, B or C (sands, gravels, sandy loams, silty loams) are more efficient in conveying ponded water to groundwater (i.e. they are more permeable) than are poorly drained substrates associated with hydrologic Group D (clays, substrates in high water tables, shallow substrates over impervious materials). Consequently, recharge is considered to be only half as effective in Group D substrates as in Group A, B or C substrates. Where available, county soils maps (Appendix 3) should be consulted to obtain the necessary information. If the wetland is larger than 80 ha, consider the adjacent area within 500 m of the wetland boundary. For wetlands smaller than 80 ha, consider the adjacent area within the distance defined by the radius of the wetland. NOTE: only substrates adjacent to the wetlands are to be considered, *not* substrates within the wetland itself.

EVALUATION:

Circle only one choice that best describes the soils in the area surrounding the wetland (i.e., soils within the wetland are not scored under this attribute) being evaluated.

NOTE: if soils surrounding the wetland cannot be classified into any of the categories presented in the table below, score 0 points.

	Substrate Adjacent to Wetland	
Dominant Site Type	Group A, B, C (sands, gravels, loams)	Group D (clays, substrates in high water tables, shallow substrates over impervious materials such as bedrock)
Lacustrine or on St. Mary's River	0	0
Isolated	10	5
Palustrine	7	4
Riverine (not on St. Mary's River)	5	2

3.3 WATER QUALITY IMPROVEMENT

Photo: Regina Varrin

The quality of the water discharged from a wetland reflects the quality of the water entering the wetland and the chemical transformations that occur in the wetland (Carter *et al.* 1978). Wetlands temporarily store some nutrients such as phosphorus and nitrogen, but they do not normally retain them (Devito *et al.* 1989). Even when nutrients are removed permanently through the accumulation of organic soils, the removal rate is small relative to the net exchange through the wetland (Urban and Eisenreich 1988; Whigham and Bayley 1978). Gehrels and Mulamoottil (1990) have demonstrated that while some wetlands release less total phosphorus than they receive, wetlands also transform sediment-bound phosphate to plant-available ortho-phosphate, which may contribute to downstream eutrophication problems.

The ability of wetlands to improve water quality depends on the rate of water flow through the wetland and its position in the drainage basin. Johnston *et al.* (1990) found that wetlands were more effective at removing suspended solids, total phosphorus, and ammonia during high flow periods, but were more effective at removing nitrates during low flows. Hill and Warrwick (1987) showed that wetlands can also transform the chemical characteristics of emerging groundwater. The results of these studies show that the water quality benefit from wetlands is not in the total retention of chemical elements but in the temporary storage and transformation of elements.

Short term water quality improvement is evaluated by (1) a watershed improvement factor estimated by site type, (2) land use adjacent to and upstream from the wetland, and (3) dominant vegetation form within the wetland.

3.3.1 Watershed Improvement Factor (WIF)

The ability of a wetland to improve water quality is based primarily on the location of the wetland in the watershed rather than on the size of the wetland. There is evidence that wetlands that represent less than 5% of the watershed can have a significant benefit (Hill 1990). However, for wetlands to be important in water quality improvement they must be located between contributing areas and receiving areas.

Long term improvement of water quality refers to the capacity of inorganic sediments and organic soils to more or less permanently "lock up" nutrients and other chemicals from the water in the wetland. This results in the wetland serving as an "ecosystem of last contact" (Holland *et al*. 1990; Johnson and Naiman 1987), receiving all the material (nutrients, contaminants, sediments, etc.) from upstream environments (via both surface and ground-water flow) before it is passed downstream to a water body such as a stream, river, and/or lake. Where wetlands are adjacent to streams and lakes, the wetlands act as the final filters of land-sourced materials before they enter the water body. Hence, those wetlands can play a disproportionate role in biogeochemical exchanges between terrestrial ecosystems and aquatic ecosystems.

Any wetland with organic soils can retain nutrients, and thus provide protection for recharging groundwater. Major delta marshes (Whigham and Bayley 1978) and peat forming wetlands that are still actively accumulating peat (Urban and Eisenriech 1989) would be places where wetlands perform this function well. Since buried nutrients are not available to plants, such wetlands have a net nutrient accumulation in sediments over time (Phillips 1989) and can be said to play a role in water quality improvement. However, the accumulation is small relative to the annual throughput. For example, the net burial of nitrogen in a bog was only 10% of the annual throughput (Urban and Eisenreich 1989).

To a large degree, location of a wetland in the landscape will determine its ability to remove nutrients. For example, wetlands located where rivers enter large inland lakes or reservoirs and deposit some of their sediment load would have value as long term nutrient sinks. Hence wetlands in hydrologically strategic locations receive high scores for water quality improvement.

EVALUATION:

Site Type (IF)	Improvement Factor
Isolated	FA____ x 0.5 = _____
Riverine	FA____ x 1.0 = _____
Palustrine with no inflow	FA____ x 0.7 = _____
Palustrine with inflows	FA____ x 1.0 = _____
Lacustrine on lake shoreline	FA____ x 0.2 = _____
Lacustrine at lake inflow or outflow	FA____ x 1.0 = _____

Watershed Improvement Score (IF x 30) (maximum = 30)_____

3.3.2 Adjacent and Watershed Land Use

The benefits that a wetland provides for water quality improvement downstream must consider what inputs it must treat. Wetlands provide an important and immediate benefit to water quality when land use practices immediately upstream and adjacent to the wetland produce organic or metal wastes which enter the wetland. Municipal, industrial and agricultural wastes are altered by biochemical and oxidative processes. Aquatic bacteria can mineralize dissolved organic molecules including toxins.

Sediments and chemicals are added to the surface waters in those areas where natural ecosystems have been disturbed. Disturbances include (1) broad scale land disturbance such as urban development, golf courses, agriculture, and logging; (2) linear upslope land uses such as roads, railways, hydro-corridors and pipelines, and (3) point sources producing industrial effluents such as mines, heavy industry and pulp and paper plants. Wetlands are extremely important in improving water quality when they are positioned in the watershed next to, or downstream from, such land uses.

The type of land use within a wetland's watershed is determined in various ways depending upon the size of the watershed. For small watersheds (less than 200 km^2), NTS maps are indispensable and field work is often useful. For larger areas, the application of general geographical and land use knowledge of northern Ontario should be used. Aerial photographs to the extent feasible, and particularly for areas near to the wetland and immediately upstream, should always be examined to see whether any of the above land uses can be determined.

EVALUATION:

STEP 1: Determination of Maximum Initial Score

_____ Wetland on the Great Lakes or St. Mary's River (Go to Step 5a)

_____ All other wetlands (Go through steps 2, 3, 4, and 5b)

STEP 2: Determination of Broad Upslope Land Use (BLU)

Assess broad upslope land uses as logging within the previous 5 years, agriculture, or other activities which alter the natural vegetation cover in an extensive manner.

Choose one	*Score*
> 50% of upslope area	20
20-50% of upslope area	14
1-20% of upslope area	4

STEP 3: Determination of Linear Upslope Land Uses (LUU)

Assess linear upslope uses (LUU) e.g., roads, railways, hydro corridors, pipelines, etc., crossing the upslope catchment within 200 m of the wetland boundary.

Choose the highest only	*Score*
Major corridor[1]	15
Secondary corridor	11
Tertiary corridor	6
Temporary or abandoned	3
None	0

STEP 4: Determination of Point-source Land Uses (PS)

Assess point source (PS) land uses producing industrial effluents, such as heavy industry, pulp and paper plants, mines, major aggregate operations (but not small pits used for local road construction) etc. Score as 'present' only if a point source land use is located less than 1 km upstream from the wetland.

Present	15
Not present	0

STEP 5: Calculation of total score for Adjacent and Watershed Land Use

a) Wetland on the Great Lakes or St. Mary's River 0

b) All other wetlands, calculate as follows:

Final Score BLU + LUU + PS_____

1. Major, secondary and tertiary roads are those that are indicated as such on the provincial highways map. Major hydro corridors are trunk lines coming directly from a generating station. Major pipelines are trans-continental lines. Secondary corridors are regional distribution lines (i.e. multi-cable hydro corridors not emanating directly from a generating station or regional gas distribution lines). Tertiary corridors are single hydro lines or local gas distribution lines (i.e. to domestic users).

3.3.3 Vegetative Form

Some wetland vegetation forms are more important in the short term removal of nutrients from water than others. The efficiency of removal is proportional to the vegetation forms present (Adamus and Stockwell 1983). Annual plants with high primary productivity will provide the maximum rate of nutrient uptake but most of the nutrients will be subsequently released as the annual biomass decomposes. However, since maximum uptake occurs during the late spring and early summer, annual plants have the potential to remove nutrients during the period when downstream ecosystems are most biologically active. Depending on the rate of nutrient removal and the biogeochemical transformations that take place in the wetland, this nutrient removal may serve a temporary, seasonal, water quality benefit.

Trees and shrubs are more long lived than emergents or submergents, and, therefore, tie up a fraction of their annual nutrient uptake for a longer period of time. Nevertheless, they still release a large portion their annual biomass growth as litter fall. However, the cycle of nutrient retention and release is not as seasonally dependent as in the case of annual plants.

In the long-term (i.e. many years) the vegetation type of a wetland should be insignificant to nutrient retention. It is the soil condition which determines the rate of decomposition and, therefore, the nutrient pool that is buried in undecomposed organic material. The evaluation by vegetation type presented below addresses only the short-term, meaning seasonal, water quality benefits.

Trees and shrubs tie up some nutrients during annual growth, but also release much of their annual growth as litter each fall. Photo: Sam Brinker

EVALUATION:

Choose the category that best describes the vegetation of the wetland.

Choose one	*Score*
1) Trees, shrubs or herbs	8 points
2) Emergents, submergents	10
3) Little or no vegetation	0

3.4 CARBON SINK

Photo: Regina Varrin

Wetlands that are actively accumulating organic soils in the form of peat are a "sink" for atmospheric carbon dioxide. Many of Ontario's wetlands are actively accumulating peat (Riley, 1983 1987, 1988; Riley and Michaud 1989). Gorham (1991) estimates that approximately one third, or 455 Gt (gigatonnes), of the world's terrestrial carbon is stored in peatlands. While each individual peatland makes up only a small portion of the total peatland carbon store, Ontario's wetlands make a significant contribution to the total store of terrestrial carbon.

If a wetland is drained, the peat is mineralized and carbon is released to the atmosphere as carbon dioxide, an important 'greenhouse gas'. It is estimated that approximately 2% of the present increase (1880 - 1980) in atmospheric CO_2 is due to carbon released from mineralized peatlands due to drainage. It needs to be stressed that developing organic soils cannot trap carbon unless the soil remains saturated so that soil oxidation cannot take place. Hence this function of wetlands is evaluated in the hydrological component.

NOTE: Refer to soils information recorded under section 1.1.1 when evaluating this attribute. If no organic soils are identified, the wetland cannot be scored as having organic soil here.

EVALUATION:
Choose only one of the following:

	Score
1) Wetland a bog or fen with more than 50% organic soils	15 points
2) Wetland with organic soils occupying 10 to 50% of the area (i.e. mainly mineral or undesignated soils, any wetland type)	6
3) Marshes and swamps with more than 50% organic soil	9
4) Wetland with less than 10% of soils organic	0

3.5 SHORELINE EROSION CONTROL

Shoreline wetlands, i.e. riverine and lacustrine site types, provide a measure of protection from shoreline erosion caused by flowing water or waves. The erosion problem occurs principally when water levels are high. Wetland vegetation ameliorates the effects of flowing water and wave action and thus eliminates or reduces soil erosion. There is substantial evidence that native plants bind soil both under and above the water, reduce current and wave energy by friction, increase sediment deposition by slowing the current, and stabilize banks (Carter *et al.* 1978).

It is the kind of vegetation occupying the shoreline and the flood plain that is instrumental in reducing erosion. The wetland and associated vegetation provide a barrier-type protection against shoreline erosion. More established vegetation with stronger root systems is more resistant and resilient to erosive forces, and consequently provides more protection.

For wetlands along lakeshores, "shoreline" includes the entire area influenced by the lake, i.e. the whole of the area designated as lacustrine site type. For riverine wetlands, "shoreline" extends from the open water boundary of the wetland to the edge of the high water mark. The evaluator must determine, for the area designated as "shoreline", the area dominated by the vegetation forms listed below.

NOTE: Shoreline erosion is assessed for those wetland areas that are either lacustrine or riverine in site type. These site types do not have to be the dominant site type in the wetland; if they are present, those portions of the wetland must be assessed for erosion control.

EVALUATION:

	Score
STEP 1: Wetland entirely isolated or palustrine	0
Any part of the wetland riverine, or lacustrine (proceed to Step 2)	

STEP 2: Choose the one characteristic that best describes the shoreline vegetation.

	Score
_____ Trees and shrubs	15
_____ Emergent vegetation	8
_____ Submergent vegetation	6
_____ Other shoreline vegetation	3
_____ No vegetation	0

3.6 GROUNDWATER DISCHARGE

A wetland is a groundwater discharge area if the groundwater moves upwards from the underlying mineral substrate or emerges from surrounding uplands (Roulet 1990b). Groundwater discharging into a wetland is usually nutrient and mineral rich, allowing the development of locally unique ecosystems and supporting a rich assemblage of plants and animals. In discharge wetlands, biogeochemical transformations may occur to improve water quality. Furthermore, discharge wetlands often have local "seepage" habitats that are essential for rare species.

Hydrological and geochemical processes operating within and upslope of wetlands control the quantity and quality of water within and downslope of the wetland and hence affect the ecological function of the wetland. Wetlands receiving larger quantities of groundwater per unit wetland area generally have an enhanced supply of nutrients (Gosselink and Turner 1978).

This section is designed to measure the strength of the link between the basin and the wetland. This link controls the quantity and quality of water entering the wetland and, consequently, the importance of hydrology to the internal ecological function of the wetland. The premise of this evaluation is that the stronger the link between the wetland and its catchment, the richer the ecological diversity. Wetlands which have strong groundwater discharge from the catchment, and which exhibit high biogeochemical and hydrological activity at the wetland margin, score highest.

Accurate identification of discharge wetlands requires detailed hydrological studies beyond the scope of this evaluation. Thus, a number of features have been identified that **suggest** a discharge function. Accrual of a high number of points **indicates a strong potential for the existence of an important discharge function** for the wetland. Further investigation would be needed before the true value of the wetland for groundwater discharge could be established. Because a discharge function for the wetland is both important and difficult to determine, the points assigned to discharge are bonus points.

The quantity and quality of mineralized water received by a wetland affects its type (bog, fen, swamp, or marsh), hence wetland type is used as an index of ecological diversity. In general, bogs have the lowest nutrient status, fens are poor to rich, and swamps and marshes are generally moderate to very rich (Zoltai *et al.*1975).

Whether discharge occurs is strongly influenced by the local relief, drainage area, and hydrogeochemical characteristics of the catchment upslope of the wetland. Most of northern Ontario shares a common geological and lithological origin, so the morphometric character of a wetland basin plays a major role in determining the hydrological and ecological functions of the wetland. Large catchment areas will provide relatively more inflow to the wetland, and steeper gradients increase the rate and proportion of groundwater entering it. Enhanced groundwater discharge also occurs at local breaks in slope near the wetland margin (Winter 1988) and these zones generally have a higher nutrient supply (Malmer 1986).

A lagg may develop at the periphery of raised bogs and some fens. A lagg is a depressional zone, generally wetter than the adjacent peatland, often containing open water. It is a zone of intensive water exchange with both wetland and terrestrial ecosystems (Dai *et al.* 1974) and a zone of intensive hydrological and biological activity (Damman and French 1987).

The soil characteristics of the catchment area upslope of the wetland affect the drainage and concentration of elements entering the wetland. Deep permeable soils provide more groundwater than catchments with patchy or thin soils, or soils of low permeability (Winter 1988). Seepage zones, evidence of iron precipitates, and ultimately pH can be used to evaluate wetland ecosystems diversity. Glasser *et al.* (1990) determined the pH of systems with very low diversity (≤4.2), moderate (4.2-5.7), high (5.7-6.7), and extremely high (≥6.7).

To determine the degree to which a wetland is hydrologically linked to its catchment the evaluator must study regional groundwater information and local topography. The wetland should also be field-checked to make observations on as many of the features as possible. For each of the ten attributes, only one column is to be recorded.

1. **Wetland type.** (See Section 1.1.2). Score based on presence of that type, i.e. does not have to be the dominant type.

2. **Basin Topography.** Refer to NTS map sheets. Wetlands in flat and gently sloping marine or lacustrine terraces score lowest, those in moderately hilly and/or hummocky terrain score higher and those associated with steep slopes, and major slope breaks score highest.

3. **Fractional Area.** This is the wetland area expressed as a ratio of the entire catchment basin (wetland size: catchment basin size). Wetlands which occupy >50% of their basin score lowest, 5-50% of the basin higher, and <5% of the basin highest.

4. **Lagg Development.** Laggs are the moats that form around the perimeter of some wetlands and can be identified on aerial photographs or by site inspection. If there are no laggs, score the minimum value. If the lagg is weakly developed, or relatively small compared to the wetland, score higher (2 points). If the lagg is well developed, or if there is extensive occurrence of weak to moderately developed lagg, score the maximum.

5. **Seeps** are areas where the groundwater emerges and can be identified as zones where surface saturation produces overland flow but there is no obvious source for the surface water.

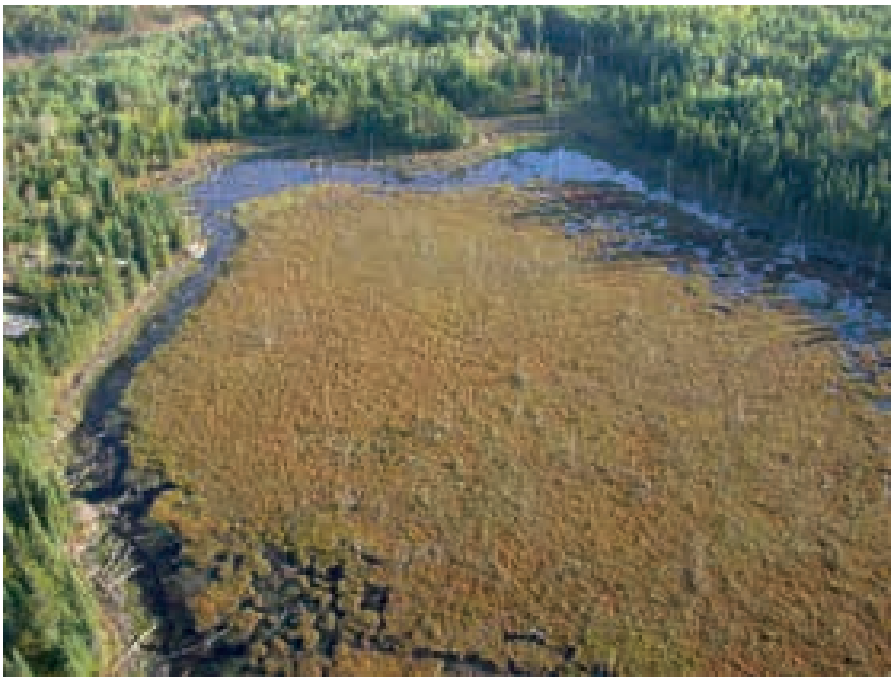
6. **Iron Precipitates.** These are formed when reduced forms of iron in groundwater come into contact with the oxygenated surface environment of a wetland. The iron precipitates appear on the surface of the wetland as reddish, "rust", spots.

7. **Marl deposits.** Calcium carbonate may be deposited as marl in areas of groundwater upwelling.

8. **Wetland pH.** Testing can be on-site, or samples can be returned to the lab for analysis. More than one sample should be taken, and at different times of the year, if possible. Average pH readings for each wetland type and score according to the highest average.

9. **Catchment Soil Coverage.** Upslope areas with extensive rock domes, exposed bedrock, etc., score low; areas with >50% soil cover at least 20 cm deep score higher; and areas with complete soil cover score the maximum.

10. **Catchment soil permeability.** Based on maps, score soils of marine or lacustrine origin low; aeolian soils, coarse tills, higher; and alluvial and outwash sands and gravels the maximum.



A "lagg" or moat at the periphery of a fen. Photo: Wasyl Baskowsky

EVALUATION:

For each category above, select the value in the appropriate column. Sum the values to determine the total score.

Wetland Characteristics	Catchment Interaction/Potential for Discharge		
	None to Little	Some	High
Wetland type Presence/absence	Bog = 0	Swamp/Marsh = 2	Fen = 5
Basin Topography	Flat/rolling = 0	Hilly = 2	Major Relief Break = 5
Wetland area: Upslope catchment area	Large (>50%) = 0	Moderate (5-50%) = 2	Small (<5%) = 5
Lagg development	None found = 0	Minor = 2	Extensive = 5
Seeps	None = 0	≤ 3 seeps = 2	> 3 seeps = 5
Iron precipitates	None = 0	≤ 3 sites = 2	> 3 sites = 5
Surface marl deposits	None = 0	≤ 3 sites = 2	> 3 sites = 5
Wetland pH	Low < 4.2 = 0	Moderate 4.2-5.7 = 5	High >5.7 = 10
Catchment soil coverage	Patchy = 0	Thin (<20 cm) = 2	Thick = 5
Catchment soil permeability	Low = 0	Moderate = 2	High = 5

Maximum score for Groundwater Discharge is 30 points

4.0 SPECIAL FEATURES COMPONENT

Eastern musk turtle Photo: Joe Crowley

The Special Features Component brings together some geographical, biological and ecological attributes of wetlands that cannot logically be evaluated under the biological, social or hydrological components. This section evaluates the geographical rarity of wetland types, occurrence of rare species and unusual wildlife, and habitat quality for wildlife, including fish. Ecosystem age is also considered in this component.

For the most part, in this component, evaluators score for features present within the wetland itself. However, it is important to remember the principles of connectivity in the landscape. For example, the forested upland surrounding a wetland may provide essential foraging habitat for raptors that nest in the wetland. Conversely, many turtles, dependent on the wetland for food and shelter, actually nest in nearby upland areas. Some studies indicate that disrupting adjacent upland areas threatens to reduce wetland biodiversity to the same extent as losing one half of the wetland itself. Many wildlife species that use wetlands spend part of their life cycle in upland habitats adjacent to the wetland itself. While not scored, evaluators are encouraged to make note of features present in the lands adjacent to the wetland being evaluated. Such information may be useful to biologists and planners in the future. A space has been provided in the data record for any such notes.

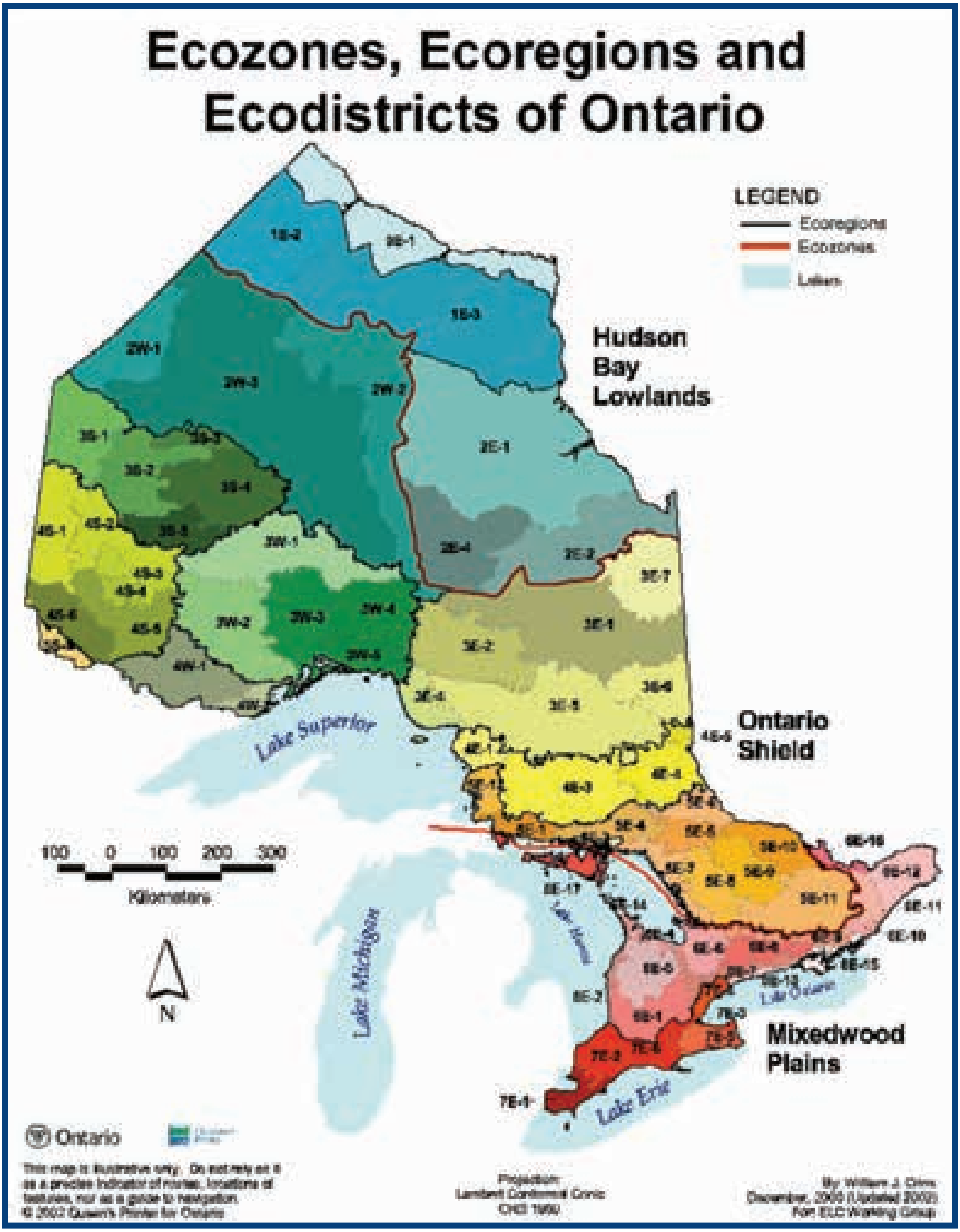


Figure 21: Ecozones, Ecoregions and Ecodistricts of Ontario (The northern OWES manual applies to Ecoregions 2, 3,4 and 5)

NOTE: for illustrative purposes only; evaluators should use the Ecodistrict layer available through Land Information Ontario (http://www.mnr.gov.on.ca/en/Business/LIO/index.html).

4.1. RARITY

4.1.1 Wetland Types

Wetlands support distinctive plant communities, often including rare and unusual species. For example, species such as snake-mouth orchid (*Pogonia ophioglossoides*), grass-pink orchid (*Calopogon pulchellus*) and the pitcher plant (*Sarracenia purpurea*) occur only in fens or bogs. When bogs or fens are rare, these species and others adapted to these ecosystems are also rare. Unlike plants, animal species of wetlands tend to be more mobile and may depend on wetlands only for specific parts of their life cycle. Nevertheless, if vital wetland habitat is rare, animal species that depend on wetlands will also be rare.

The assessment of rarity of wetland types in northern Ontario is based on Hills (1961) Site Regions. In 2000, MNR updated the Hill's Ecodistricts to better align with physiographic information on the landscape (Crins *et al*. 2009). In Ecoregion 5E, where more information on wetland types is available, the evaluation is based on Ecodistrict (see Figure 24). The score assigned to each of the wetland types within each site region or district was arrived at by consensus of the PWWG and reflects a collective assessment based upon general knowledge of wetlands in northern Ontario. As actual wetland evaluation and inventory data are accumulated, however, some of these scores will likely need to be adjusted.

Notes to the Evaluation Table:

Scoring on wetland type representation is as follows:

30 = area of that type accounts for less than 10% of the total wetland area of that site region or district.
20 = area of that type accounts for between 10 and 30% of the total wetland area in that site region or district.
10 = area of that type accounts for between 30 and 50% of the total wetland area in that site region or district.
0 = area of that type accounts for more than 50% of the total wetland area of that site region or district.

Score each wetland type based on presence of that type in the wetland being evaluated. Sum scores for all types that are present across the row for the appropriate Site Region or Site District. Maximum score is 70 points.

For wetlands located within more than one Ecodistrict, score for the Ecodistrict where the majority of the wetland is located. For example, a wetland with about 70% of its area located within Ecodistrict 5E-5 and about 30% of its area within Ecodistrict 5E-6 should be scored under Ecodistrict 5E-5 (where a marsh would receive 10 points and a fen 20 points).

Table 6. Evaluation Table for Scoring for Wetland Rarity in the Landscape and Rarity of Wetland Type

Unit Number	Site Region & District	Marsh	Swamp	Fen	Bog
2E	James Bay	20	20	0	20
2W	Big Trout Lake	20	20	0	10
3E	Lake Abitibi	20	20	10	0
3W	Lake Nipigon	20	20	10	0
3S	Lake St. Joseph	20	20	10	0
4E	Lake Temagami	20	20	10	0
4W	Pigeon River	20	10	20	0
4S	Wabigoon Lake	20	10	20	0
5E-1	Thessalon	10	0	30	20
5E-3	La Cloche	20	0	30	20
5E-4	Sudbury	10	0	30	10
5E-5	North Bay	10	0	20	0
5E-6	Tomiko	10	0	20	0
5E-7	Parry Sound	20	0	30	20
5E-8	Huntsville	20	0	30	20
5E-9	Algonquin Park	10	0	30	0
5E-10	Brent	20	0	30	0
5E-11	Bancroft	0	10	30	10
5E-13	Western Sault Ste. Marie – Lake Superior Coast	20	0	10	30
5-S	Lake of the Woods	10	10	20	10

4.1.1 Rarity of Wetland Type

Score is cumulative, based on presence/absence. Circle all appropriate scores from above table and sum.

Score (maximum 80 points) _____

4.1.2 Species

The causes of rarity or scarcity of species are many and varied, and may be natural or related to human activity. Rarity may be brought about by the lack of suitable habitat, habitat degradation, predation, competition, disease, pollution, habitat destruction or commercial collecting. Some species are rare because they occur in the province at their range peripheries, while others occur naturally at low population levels. Some species have always been rare for reasons unknown.

Whatever the causes of rarity, rare species are almost universally considered to be important and worthy of protection. Rare and localized species tend to be more susceptible to extinction events than are common or more widely distributed species. Extirpation or extinction inevitably means the loss of the species within a jurisdiction or everywhere. In addition to their intrinsic value, many species have economic and direct social worth and the drastic reduction in their populations to the point of 'rarity' reduces benefits to humans accordingly.

Rare species may be encountered during the course of field work associated with wetland evaluation. However, it takes time in the field, over different parts of the season to discover what rare species are present in the wetland or using it from time to time. Thus, most information will come from existing sources. All existing literature relating to the wetland being evaluated should be investigated for information on significant species. The evaluator should examine alternative sources (e.g., scientific papers, ANSI and Environmentally Sensitive Area reports, International Biological Program reports, government reports, conservation authority management plans or studies, naturalist club publications, consultant reports, wildlife monitoring surveys, and any other available sources).

In all cases, a species is to be scored only once and must be listed at the highest applicable category.

Bogbean Buckmoth Photo: Regina Varrin

Using NHIC's Element Occurrence Data

An "element" refers to an individual component of biodiversity (e.g., a species or an ecological community). An "element occurrence" refers to a location of an element of biodiversity on the landscape (e.g., an area of land and/or water in which a species or ecological community is or was present). An "element occurrence observation" is the actual observation made of the element. Element Occurrences (EOs) are often comprised of several EO observations.

The Natural Heritage Information Centre (NHIC) maintains an extensive database of EOs in Ontario. An EO and its underlying observation data can be useful information to help evaluators determine the possible presence of a species that may be scored under this evaluation system. EO observation records identify the species, location, date of the observation, accuracy or reliability of the observation/occurrence and sometimes include notes made by the observer (such as the habitat of the occurrence).

An EO on its own should not be scored without first consulting and considering its accompanying observation data. Evaluators must ensure to the best of their ability that species identified using EO data meet the criteria for each section in 4.1.2 before being scored.

If there is any doubt about the relevance of the EO, the evaluator should obtain more information. If there continues to be uncertainty concerning whether or not an EO should be scored, it is best not to use it.

Massassauga Photo: Joe Crowley

Documentation of Species Observations

UTM coordinates (preferably through use of a GPS unit) should be recorded for all rare species observed in the field. **Species observation information for *provincially-tracked* breeding or reproducing species should be forwarded to the NHIC (https://www.ontario.ca/page/report-rare-species-animals-and-plants) for incorporation into the provincial record.**

The wetland evaluator must document the EO ID (if scoring for an existing EO) and the observation should be submitted to the NHIC along with information associated with the observation.

NOTE: information on the location of rare species should not be included in a publicly accessible WEDSR or final wetland map. When recording information for this component, it can be important to distinguish between a lack of knowledge (i.e., no surveys completed in wetland), as opposed to a lack of observation (i.e., surveys completed but species not found) of the presence of rare species. Evaluators should include such comments in the data record.

In all cases, the presence of all significant species listed in the wetland evaluation must be fully documented. Guidelines for proper documentation are provided below:

1. Full references for reports.
2. Full references for non-report information (e.g., Rare Breeding Bird Program), including source name, position, date and record number.
3. Photographs that accurately show identifying features of the rare species.
4. **The scientific names of species scored in the following sections**, especially with regards to plant or invertebrate species, must be recorded in the data record. Names should follow NHIC nomenclature.
5. Where numbers warrant or specimen identification is uncertain or tricky, voucher specimens of significant plants collected from the wetland, accurately identified and deposited in a recognized herbarium.
6. Voucher specimens of rare insect species scored in the following sections should be accurately identified, labeled and deposited in established research collections for future reference and verification. Notes on the locations of voucher specimens should accompany the data record and copies of the insectarium labels should be attached to the data record.
7. Full names, position, address and telephone numbers of observers for personal communications.
8. Full references for any verified Element Occurrence (of any species) in the EO provincial data record, EO number, observation dates, EO rank information, observer(s), date information accessed from database).

Animal species located outside wetland boundaries

Normally, for a species to be scored in one of the categories below, it must be found within the wetland boundaries. However, under some conditions exceptions may be made for animals, only. A number of wetland dependent wildlife species also need surrounding terrestrial habitat to complete portions of their life cycle.

Wetland evaluators may encounter wetland-dependent species outside the wetland boundary, depending on the season of visit, or just by happenstance. Common examples include: upland nesting sites for turtles; seasonal use of uplands for foraging and hibernation by some frog, toad and salamander species; upland nesting sites used by waterfowl; upland foraging by birds which nest in wetlands; and upland corridor linkages between wetland units traversed by mammals, reptiles and amphibians.

When an animal species that is provincially, regionally or locally significant, is found outside the wetland in the surrounding upland, but where it also makes **sound ecological sense** that such an individual or group of animals is dependent on that wetland for an essential part of its life cycle, then a score can be recorded in the appropriate category. Since different animal species have different home range sizes, and utilize surrounding uplands in different seasons an evaluator must use their professional judgement. Also, the landscape context is critical to the decision. Where wetlands on the surrounding landscape are few, and it makes ecological sense that the animal observed outside the wetland is likely associated with that wetland, then the decision should be to include that species for scoring. Where it is not obvious, based on landscape wetland pattern, and using a sound ecological rationale, that a species is using the wetland, then the species occurrence should not be scored.

Blanding's turtle Photo: Joe Crowley

Upland plant species within the wetland

Rare plant species that are most commonly found in upland areas and occasionally in wetlands may be scored in some cases, if the area in which they are found is not part of a large upland area within the wetland.

4.1.2.1 and 4.1.2.2 Provincially Significant Animal and Plant Species

Provincially tracked species are determined by the Natural Heritage Information Centre (NHIC).

A species is considered to be provincially significant if it is tracked by the NHIC. Species lists are available on the natural heritage information webpage (https://www.ontario.ca/page/get-natural-heritage-information) that include whether species are tracked along with other conservation information.

Provincially tracked species are defined as elements of biodiversity for which there is conservation concern at a global, national or provincial level. These include species or assemblages of species (e.g. plant communities or wildlife concentration areas) and federally or provincially listed species at risk. Species actively "tracked" generally have fewer than 80 recent occurrences in Ontario or are listed species at risk in Ontario. Species at risk are one subset of species tracked provincially; therefore methods outlined in this document apply equally to species at risk as they do to all other provincially tracked species. The Natural Heritage Information Centre (NHIC) manages Ontario's list of provincially tracked species and actively gathers and maintains observation and occurrence information for these species.

Evaluators must keep in mind that "fauna" in this section includes invertebrates, and the NHIC lists for these groups should be consulted early on in the evaluation process to gain familiarity with provincially rare butterflies, dragonflies, or mussels, for example, which may be using the wetland under investigation.

For a faunal species to be scored under this section, it must be documented to use the wetland and this use must be in support of its life cycle (however, see previous section on 'animal species located outside the wetland boundaries' and section on 'upland plant species within the wetland'). Examples would be breeding or feeding for all groups including non wetland-dependent species; basking sites for turtles or snakes; and resting sites for migratory waterfowl. With respect to flora, provincially significant vascular and non-vascular plants are to be scored, and the scientific name must be included in the data record.

Clear documentation detailing what the species was doing when observed must be included in the data record under this category (e.g., feeding, undertaking a courtship display, using a hibernaculum, nesting, etc).

NOTE: Some species, generally birds, breed rarely in Ontario but are fairly common non-breeders (migrants, transients). Such species will contain a "B" as part of their provincial (S) rank. Such species can be scored under this category only if the evaluator has a record of the species using the wetland to breed. Other species have dual ranks, e.g., S1B, S2N. These species may be scored as provincially significant if observed using the wetland in any way necessary to support its life cycle. In other cases species may be partially tracked, only. For example a species may be ranked as S2N, S4B if it is too common as a breeder in Ontario to be tracked but is tracked based on the rarity of winter aggregation sites or migratory concentration areas. In these situations the species may be scored under this category only for that aspect of its life cycle that is tracked.

EVALUATION:

Number of provincially significant plant or animal species in the wetland:

One species	=	50 points	14 species	=	154
2 species	=	80	15 species	=	156
3 species	=	95	16 species	=	158
4 species	=	105	17 species	=	160
5 species	=	115	18 species	=	162
6 species	=	125	19 species	=	164
7 species	=	130	20 species	=	166
8 species	=	135	21 species	=	168
9 species	=	140	22 species	=	170
10 species	=	143	23 species	=	172
11 species	=	146	24 species	=	174
12 species	=	149	25 species	=	176
13 species	=	152			

Evaluate animal and plant species separately and add scores together (for example, if 3 animal and 2 plant species, the score would be 95+80=175).

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

(no maximum score)

4.1.2.3 and 4.1.2.4 Regionally and Locally Significant Species

Regionally and locally significant species are those that occur in a few populations or in very restricted distribution on a regional or local scale. Ecoregions and Ecodistricts are the basis for assessment of significant species; however, it is recognized that appropriately organized data do not currently exist for most groups of species. In the past, documentation of significant species has focused on counties, regional municipalities and other administrative areas. Where necessary, information organized by administrative boundaries will be used in the assessment until such time as ecoregion or ecodistrict lists are available. **For groups of species or geographic areas with no list of rare species, no score can be assigned for this component.**

It is possible to score regionally significant bird species throughout northern Ontario and locally significant plant species in a number of areas in northern Ontario.

There is one list that is approved for scoring regionally significant faunal species (see Appendix 5).

Appendix 6 provides a list of approved references to be used in assessing **regional and local significance for plants.**

The ministry may make lists that could be used in addition to or instead of those described in Appendix 5 and 6 available for time to time.

For plant and invertebrate species, the scientific name **must** be included in the data record. **For a species to score as regionally or locally significant there must be evidence of breeding or feeding during the breeding season, or repeat observations of use, in at least two different years within a ten year period, during migration.**

EVALUATION:

4.1.2.3 Number of species significant in Ecoregion

One species	= 20 points	6 species	= 55
2 species	= 30	7 species	= 58
3 species	= 40	8 species	= 61
4 species	= 45	9 species	= 64
5 species	= 50	10 species	= 67

For each significant species over 10 in wetland, add 1 point.
(no maximum score)

4.1.2.4 Number of species significant in Ecodistrict

One species	= 10 points	6 species	= 41
2 species	= 17	7 species	= 43
3 species	= 24	8 species	= 45
4 species	= 31	9 species	= 47
5 species	= 38	10 species	= 49

For each significant species over 10 in wetland, add 1 point.
(no maximum score)

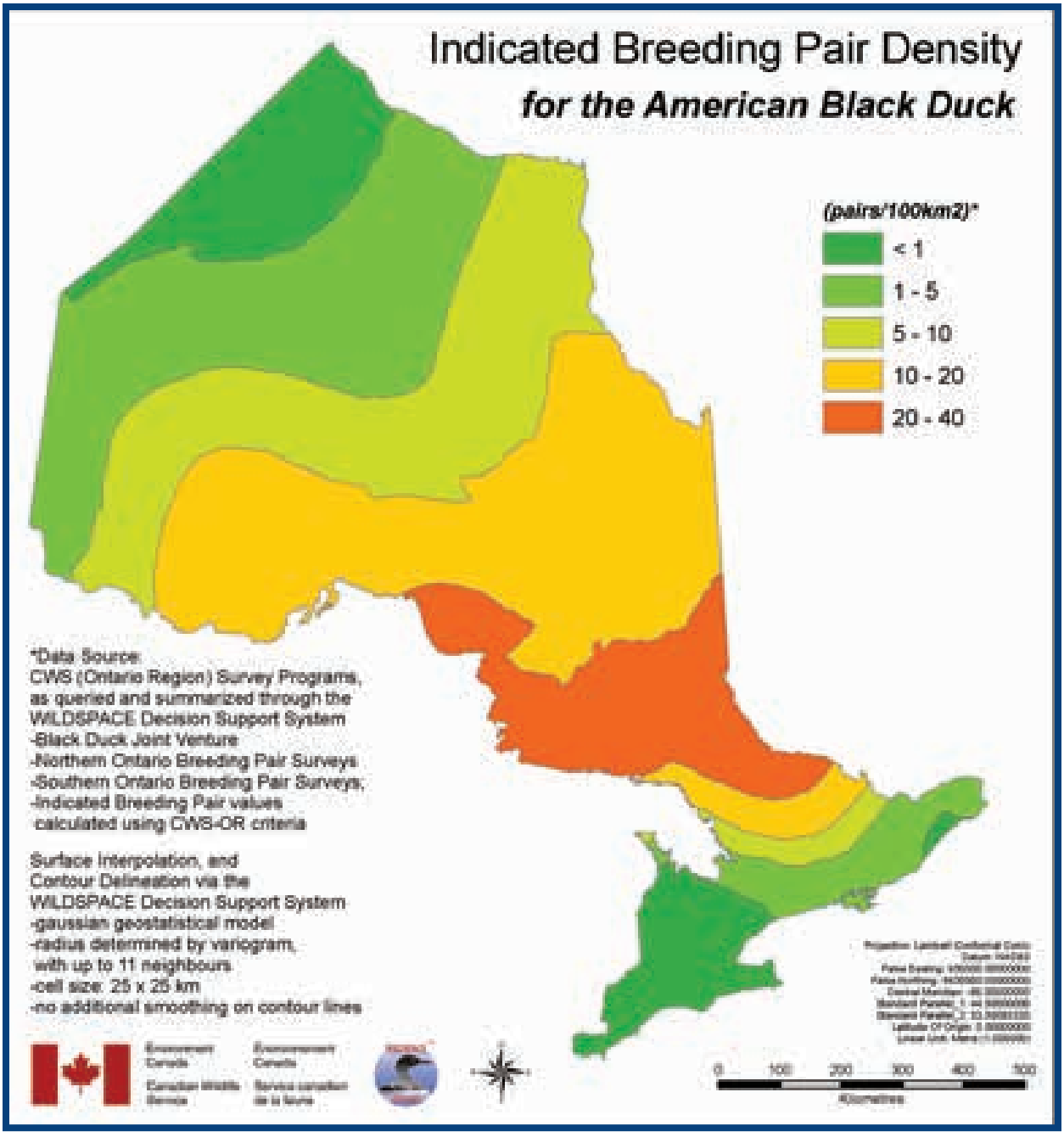


Figure 22: Indicated Breeding Pair Density for the American Black Duck based on data collected between 1989-2005.

4.1.2.5 Species of Special Status

Wetlands containing species that are the subject of unusual interest or unique concern are identified in this attribute. Only the American Black Duck is recognized.

American Black Duck

The American Black Duck is recognized as a species of international concern by the Black Duck Joint Venture (BDJV)under the North American Waterfowl Management Plan (NAWMP). The BDJV[1] was formed in 1989 to implement a cooperative population monitoring, research, and communications program to provide information required to manage black ducks and restore numbers to the North American Waterfowl Management Plan (NAWMP) goal of 640,000 breeding birds in the original breeding ground survey area. In southern Ontario the American Black Duck has been reduced to very low populations while the mallard has increased substantially. Figure 25[2] shows the estimated breeding density of this species in Ontario.

For a wetland to score in this category, at least 0.5 ha of suitable brood-rearing habitat must be available. American Black Duck broods require emergent vegetation for cover and shallow water for feeding. Marshes and swamps and sometimes fens provide this type of habitat but it is less common in bogs. If a minimum of 0.5 ha of suitable habitat is available, locate the wetland in Figure 22 and score according to the following categories.

EVALUATION (American Black Duck)::

20 - 40	"	= 20
10 - 20	"	= 15
5 - 10	"	= 10
1 - 5	"	= 5
habitat not suitable		= 0
out of assessment range		= 0

(Determine category from Figure 25; , *maximum score 20 points*)

1. The BDJV is a partnership-based conservation program consisting of member agencies and organizations with responsibility for or interest in the conservation and management of black ducks and other species that share its range. Member organizations include Federal, state, and provincial wildlife management agencies in the U.S. and Canada (including the Ontario Ministry of Natural Resources and the Canadian Wildlife Service) as well as non-government agencies such as Ducks Unlimited. (www.blackduckjv.org).
2. WILDSPACETM 2006. WILDSPACETM : A Geo-spatial Integration of Diverse Wildlife Survey and Ecological Information in Ontario and beyond. Canadian Wildlife Service – Ontario, Environment Canada, Ottawa, Ontario, Canada.

4.2 SIGNIFICANT FEATURES AND HABITATS

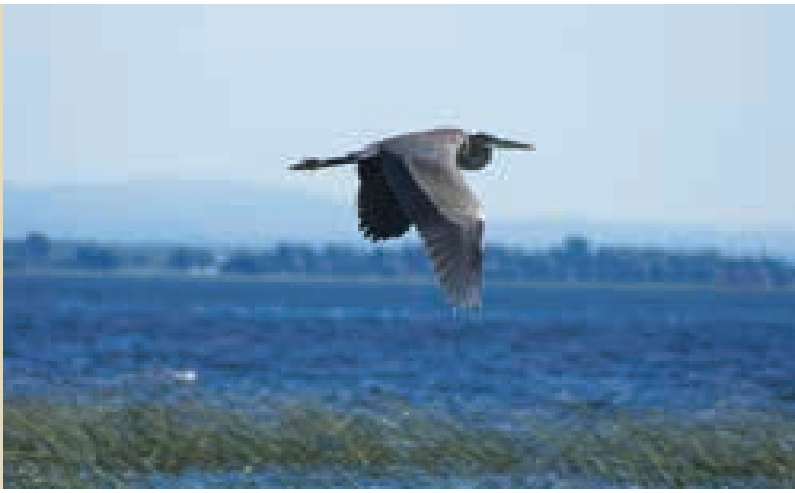


Photo: Rebecca Zeran

Some wetlands have special importance as wildlife habitat because of their geographical location or the unusual nature of their habitat. This subcomponent records and evaluates six significant habitats or features.

When scoring this section, evaluators may want to refer to the Significant Wildlife Habitat (SWH) Technical Guide (OMNR 2000) and its' supporting tools and documents Information and criteria in the SWH guide may aid wetland evaluators in identifying and/or determining the significance of features scored under this evaluation system. The SWH guide provides technical information on the identification, description and prioritization of wildlife habitat, including:

- colonial bird nesting sites
- winter deer yards
- moose late winter habitat
- waterfowl stopover and staging areas
- waterfowl nesting
- shorebird migratory stopover areas
- raptor winter feeding and roosting areas
- moose calving areas, and
- moose aquatic feeding areas

Evaluators are encouraged to record information on wildlife habitat observed while in the field (e.g., dens, stick nests, calving areas, fish spawning areas) and include it in the wetland file.

4.2.1 Colonial Waterbirds

In comparison to most other species of birds, colonial waterbirds represent a special type of secondary and tertiary productivity. The nesting of these birds is localized, is of special interest to many people and the colonies are quite vulnerable to destruction. Some wetland areas, while not used for nesting, are regularly used as feeding areas by the members of a nearby colony. To score feeding, observations should be made during the breeding period for that species.

List of colonial wetland-dependent nesting birds that can be scored under this section:

- Red-necked Grebe (*Podiceps grisegena*),
- Black-crowned Night Heron (*Nycticorax nycticorax*),
- Great Egret (*Casmerodius albus*),
- Black Tern (*Chlidonias niger*),
- Caspian Tern (*Sterna caspia*),
- Common Tern (*S. hirundo*), and
- Great Blue Heron (*Ardea herodias*) – **scored for nesting occurrences, only**

NOTE: Great blue herons are scored for nesting, but are excluded from scoring for feeding because they occur in nearly all wetlands in southern Ontario.

The name of species scored and documentation (sources of information) must be included in the data record.

EVALUATION: Check one only

Currently nesting colony	=	50 points
Known to have nested within the past 5 years	=	25
Active feeding area (great blue heron excluded)	=	15
None known	=	0

(Score highest appropriate category, *maximum score 50*)

4.2.2 Winter Cover for Wildlife

The existence in certain wetlands of significant winter cover for wildlife species is a specialized ecosystem value recognized in this section. Many species of wildlife can more readily survive if suitable winter cover exists in a wetland. Good winter cover for wildlife species would include the presence of conifers (excluding tamarack) in dense stands or mixtures of evergreen with deciduous treesand shrubs. If dense cedar is found in a wetland, for example, a variety of winter birds may select them for night roosting. Old trees with cavities may be of importance for squirrels, mice, woodpeckers, owls, raccoons, chickadees, nuthatches, and other species. Refer to the Significant Wildlife Habitat Technical Guide and Ecoregion criteria schedules (where applicable) for more information on identifying winter cover.

An assessment of the importance of the wetland for winter cover should be carried out using criteria described in the appropriate Significant Wildlife Habitat Ecoregion Criteria Schedule. The traditional use of a wetland by a regionally significant species will not necessarily result in the wetland scoring as significant in the Ecoregion. The evaluator must judge whether the wetland is of sufficient importance to the regionally significant species to warrant this score. A wetland that scores as regionally significant will normally provide good winter cover for a number of species that do not have extensive areas of winter habitat in the Ecoregion.

Evaluators must document why the wetland is assessed as having a particular level of significance for winter cover, including sources of information.

EVALUATION:

Provincially significant	=	100
Significant in Ecoregion	=	50
Significant in Ecodistrict	=	25
Locally significant	=	10
Little or poor winter cover	=	0

(Score highest appropriate category, *maximum score 100 points*)

4.2.3 Waterfowl Staging and/or Moulting Areas

A 'staging area' is a traditional area, usually a lake, where birds that migrate in flocks rest and feed either immediately before or during migration. Many flocks may be gathered in such an area.

A 'moulting area' is an area that waterfowl use to shed old feathers. Such areas are important to waterfowl since during the moulting period they are usually unable to fly and are susceptible to disturbance.

Certain wetlands have exceptionally high value as places where large numbers of waterfowl concentrate to moult or to feed and rest prior to migration. Long Point and Lake St. Clair are two such outstanding areas for migration in southern Ontario and are important at a national level. Other wetlands provide the same type of value on a provincial or regional level. Many Great Lakes shoreline marshes, for example, are staging areas. Wildlife biologists have also recently found that some wetlands provide critical habitat during the moulting season. Such wetlands contain highly desirable vegetation cover and water/shoreline configurations providing safety to the flightless birds.

An assessment of the importance of the wetland for waterfowl staging should be carried out using criteria described in the appropriate Significant Wildlife Habitat Ecoregion Criteria Schedule for "Waterfowl Stopover and Staging Areas (Aquatic)". Wetlands that meet the criteria for confirmed significant wildlife habitat will be considered as being provincially significant for waterfowl staging habitat and score 100 points under this section.

Moulting areas are poorly documented, as little research has been done. Because of this, the higher levels of this category will rarely be scored.

Note that the lowest level of significance is 'locally significant/known to occur', i.e. there must be documented records of moulting or staging waterfowl before this category can be scored. **Evaluators must document why the wetland is assessed as having a particular level of significance for waterfowl staging and/or moulting, including sources of information.**

NOTE: if a female with young is scored under this category for moulting, that same female can **not** also be scored as breeding under section 4.2.4.

EVALUATION:

	Staging	Moulting
Nationally/internationally significant	= 150	150
Provincially significant	= 100	100
Significant in the Ecoregion	= 50	50
Significant in the Ecodistrict	= 25	25
Locally significant/Known to occur	= 10	10
Not possible/Unknown	= 0	0

(Score highest applicable category for each of staging and moulting, add and total score, however *maximum score that can be recorded for evaluation is 150 points*)

4.2.4 Waterfowl Breeding

Waterfowl depend on wetlands and associated upland for breeding. Most Ontario wetlands would be categorized as being no more than locally significant. If permanent open water marsh exists, the wetland should also be scored as "habitat suitable."

An assessment of the importance of the wetland for waterfowl breeding should be carried out using criteria described in the appropriate Significant Wildlife Habitat Ecoregion Criteria Schedule for "Waterfowl Nesting Area". Wetlands that meet the criteria for confirmed significant wildlife habitat will be considered as being provincially significant for waterfowl breeding habitat and score 100 points under this section.

Evaluators must document why the wetland is assessed as having a particular level of significance for waterfowl breeding, and fully document sources of information.

EVALUATION:

Nationally/internationally significant	= 150 points
Provincially significant	= 100
Significant in the Ecoregion	= 50
Significant in the Ecodistrict	= 25
Locally significant/Habitat suitable	= 10
Habitat not suitable	= 0

(Score highest appropriate category; *maximum score: 150 points*)

4.2.5 Migratory Passerine, Shorebird or Raptor Stopover Area

All wetlands have some significance as migratory bird stopover areas and a few, such as certain wetlands along the north shores of Lakes Erie and Ontario in particular, are places where passerines and/or shorebirds in great numbers stop to rest and feed for short periods during migration.

An assessment of the importance of the wetland as a bird stopover area should be carried out using criteria described in the appropriate Significant Wildlife Habitat Ecoregion Criteria Schedule for: Shorebird Migratory Stopover Areas and Landbird Migratory Stopover Areas. Wetlands that meet the criteria for confirmed significant wildlife habitat in either category will be considered as being provincially significant as bird stopover habitat and score 100 points under this section.

Evaluators must document why the wetland is assessed as having a particular level of significance as a migratory passerine, shorebird or raptor stopover area and fully document all sources of information.

EVALUATION:

Nationally/internationally significant	=150 points
Provincially significant	=100
Significant in the Ecoregion	= 50
Significant in the Ecodistrict	= 25
Locally Significant/Known to occur	= 10
Not possible/Unknown	= 0

(Score highest appropriate category; *maximum score 150 points)*

4.2.6 Ungulate Habitat

Wetlands can provide important features of ungulate habitat and are particularly important for moose. MNR District and Area Offices must be contacted to obtain information about moose aquatic feeding areas (see Wildlife Habitat Inventory Manual, MNR 1993). Moose use both aquatic plants and mineral licks to satisfy their need for sodium. Ungulate summer cover refers to black spruce stands in which the canopy is thick enough to provide thermal cover (shade) for ungulates during the heat of summer. If the wetland is located in an area where moose do not occur then this section should score 0.

EVALUATION:

Score (1) + (2) + one of (3) to (6)

	Score
1. Ungulate summer cover	= 15 points
2. Mineral licks	= 50
3. Moose aquatic feeding area Class 1	= 0
4. Moose aquatic feeding area Class 2	= 10
5. Moose aquatic feeding area Class 3	= 20
6. Moose aquatic feeding area Class 4	= 35

(Score is cumulative for a maximum possible score of 100)

Photo: Jan McDonnel

4.2.7 Fish Habitat

The Ontario Ministry of Natural Resources (MNR) is the provincial agency responsible for the protection and management of Ontario's fisheries. Specific MNR responsibilities include: administering and enforcing the Ontario Fishery Regulations, allocation and licensing of the fisheries resource, fisheries management (e.g., stocking), fisheries management planning, fish and fish habitat information management and fish habitat rehabilitation.

The federal government has constitutional jurisdiction over both coastal and inland fisheries and is responsible for the conservation of fish and the protection of fish habitat. The Fisheries Act provides the legislative means for Fisheries and Oceans Canada to fulfill their federal mandate.

For MNR to carry out its responsibilities for the protection and management of Ontario's fisheries, it is important to identify fish habitat, including habitat available in wetlands.

Fish habitat is defined in the *Fisheries Act* as: "spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes."

Fish habitat includes spawning grounds, nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Wetland fish habitat is usually found in marsh and swamp wetland types, although fens have also been documented as providing spawning habitat in some instances. The area and quality of fish habitat can vary considerably from a small area in an isolated wetland that supports one or two species, to a large wetland that supports a great diversity of fish species.

Fish, as defined in the *Fisheries Act*, " includes *(a)* parts of fish, *(b)* shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and *(c)* the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animal".

The wetland evaluation system does not consider any one fish species to be more valuable than another; thus, the presence of individual species of fish is not scored. **Accordingly, *all* species of fish must be considered when assessing the available fish habitat (e.g., minnows as well as sportfish).**

Longnose gar Photo: Alan Dextrase

The evaluation system does recognize, however, that the quality of fish habitat varies. Therefore, the system assesses the significance of the fish habitat present. This assessment is based on either the known fisheries value of the habitat; or, if that information is not available, a qualitative and quantitative assessment of the habitat based on field observations. Assessed fisheries values are presence of spawning and nursery habitat, and presence of staging and migration habitat.

4.2.7.1 Spawning and Nursery Habitat

If the significance of the spawning and nursery habitat present in the wetland is known assessment is based upon the relative importance of the wetland at an Ecoregion (e.g., 5E), Ecodistrict (e.g., 5E-10) or local level (e.g., ecosite or community landscape level). For many areas in Ontario, the Province maintains an online database of fish records. These records can be good sources of information. The level of significance of the fish habitat is determined based on a number of factors including:

- the location of the wetland,
- the area of the fish habitat,
- the size and number of fish populations using the habitat,
- the dependency of these populations on the wetland, and
- the scarcity of this habitat at the relevant ecological level (i.e., Ecoregion or Ecodistrict).

Wetlands with fish habitat significant at the Ecoregion level may be those that contain one or more unique characteristics pertaining to the fish species or populations using the wetland. Examples of this might be the walleye spawning run in Minesing Swamp; a wetland which provides spawning or nursery habitat for a population of fish rare in the Ecoregion; or, a wetland which provides habitat for one of the best or most representative populations of Brook Trout in the ecodistrict. Any fish species listed on the SARO list that uses the wetland as spawning or nursery habitat will result in the wetland being scored "significant at the Ecoregion" level. Similar criteria can be applied to fish habitat significant at an Ecodistrict level. An example would be a species listed on an Ecodistrict-significant list (4.1.2.4) that uses the wetland as spawning or nursery habitat.

For all habitat determined to be either significant at an Ecoregion or Ecodistrict level, documentation supporting that significance must be attached to the evaluation. All other fish habitat is considered to be locally significant, with no documentation required.

If the level of significance of the spawning and nursery habitat within a wetland is not known, then assessment is based upon qualitative and quantitative information gathered in the field. This assessment divides the type of fish habitat present into three broad categories, Low Marsh, High Marsh and Swamp. It is the presence of these habitats, rather than actual use, which is being assessed.

Low Marsh contains permanent water and, therefore, provides year-round fish habitat. Such habitats are typically open water marshes containing submergent and possibly emergent vegetation. High Marsh is seasonally dry and dominated by emergent vegetation, which may be used as spring spawning or nursery habitat.

Swamp communities containing fish habitat may be either seasonally flooded or permanently flooded. For example, swamps along rivers, creeks and lakes that are inundated in the spring often provide spawning and nursery habitat for such species as northern pike, yellow perch, carp, bullheads and minnows. For seasonally flooded swamp communities to be considered as fish habitat, fish must have access to the area from areas of permanent water. Permanently flooded swamp communities providing fish habitat are most often in the form of beaver ponds or other flooded areas. These areas may be directly connected to other fish habitat, or may be isolated. Unlike Low and High Marsh, the assessment of the swamp fish habitat is not specific to vegetation forms in the swamp; it is based on area alone.

In the qualitative assessment of the fish habitat, diversity is evaluated based on the dominant form in the vegetation communities providing fish habitat and follows the concepts outlined in Janecek (1988). A quantitative assessment is added in the form of a size factor (see Table 7 below). Appendix 7 lists the key vegetation groups that must be used for habitat-based scoring. A detailed example of the habitat-based scoring procedure is presented below.

Table 7. Area Factors for Low Marsh, High Marsh and Swamp Communities

No. of ha of Fish Habitat	Area Factor
< 0.5 ha	0.1
0.5 – 4.9	0.2
5.0 – 9.9	0.4
10.0 – 14.9	0.6
15.0 – 19.9	0.8
20.0 +	1.0

In most cases, evaluators will assess the entire vegetation community for its ability to provide permanent or seasonal fish habitat. However, in some cases, a large community is encountered, where only a portion of the community's area is available as fish habitat. In this case, evaluators need to record the % of the community that functions as fish habitat. **Only the area of the vegetation community that supports fish habitat can be used in the scoring of this attribute.** The data summary form in Appendix 4 can be used to calculate areas in these cases.

Evaluators should record both a high and low estimated percentage of the vegetation community that can be used as fish habitat. Area is calculated by averaging the high and low percentages. This is the area that should be used when scoring for 'Spawning and Nursery Habitat'.

Seasonally flooded silver maple swamp. Photo: Wasyl D. Bakowsky

Example of Habitat-based scoring for Section 4.2.7.1

Figure 26 shows a wetland containing fish habitat. The dominant vegetation form, the category of fish habitat [i.e., Low Marsh (LM), High Marsh (HM), Seasonally Flooded Swamp (SF) and Permanently Flooded Swamp (PF)], and the area of each vegetation community are identified on the wetland map. The dominant form and dominant species for each vegetation community pictured in Figure 23 are listed in Table 8 below. The information from the wetland map is summarized according to fish habitat category in Table 9.

Table 8: Vegetation Communities to accompany Figure 23

Map Code	Vegetation Forms	Dominant Species
W1	su*	su: *Potamogeton amplifolius, Ceratophyllum demersum*
M2	ne*	ne: *Zizania palustris*
W3	su*, f	su: *Potamogeton nodosus, Elodea canadensis;* f; *Potamogeton natans, Nymphaea odorata*
M4	re*, ne, gc	re: T*ypha latifolia; ne: Carex stricta, Phalaris arundinacea;* gc: *Cicuta bulbifera, Lycopus americanus*
W5	f *,su, ff	f: *Nymphaea odorata, Nuphar variegatum;* su: *Potamogeton gramineus, Myriophyllum exalbescens; ff:Lemna minor*
W6	be*, ne, f, su	be: *Pontederia cordata; ne: Sparganium Sparganium emersum, Carex aquatilis;* f: *Nymphaea odorata, Nuphar variegatum;* su: *Potamogeton gramineus, Elodea canadensis*
S1	h(*), gc	h: *Acer saccharinum, Acer rubrum;* gc: *Onoclea sensibilis, Pilea pumila*
S2	ts(*), ne, gc	ts: *Alnus rugosa, Fraxinus pennsylvanica;* ne: *Phalaris arundinacea, Carex bebbii;* gc:*Thelypteris palustris, Lythrum salicaria*
S3	h(*), ts, ne, gc	h: *Acer rubrum, Fraxinus nigra;* ts: *Acer rubrum, Betula pappyrifera;* ne: *Carex intumescens, Poa palustris;* gc: *Onoclea sensibilis, Bohemeria cylindrica*
S4	dh(*), f, su, ff	dh: *dead deciduous trees;* f: *Potamogeton natans, Nymphaea odorata;* su: *Potamogeton zosteriformis, Potamogeton pectinatus;* ff: *Lemna minor*

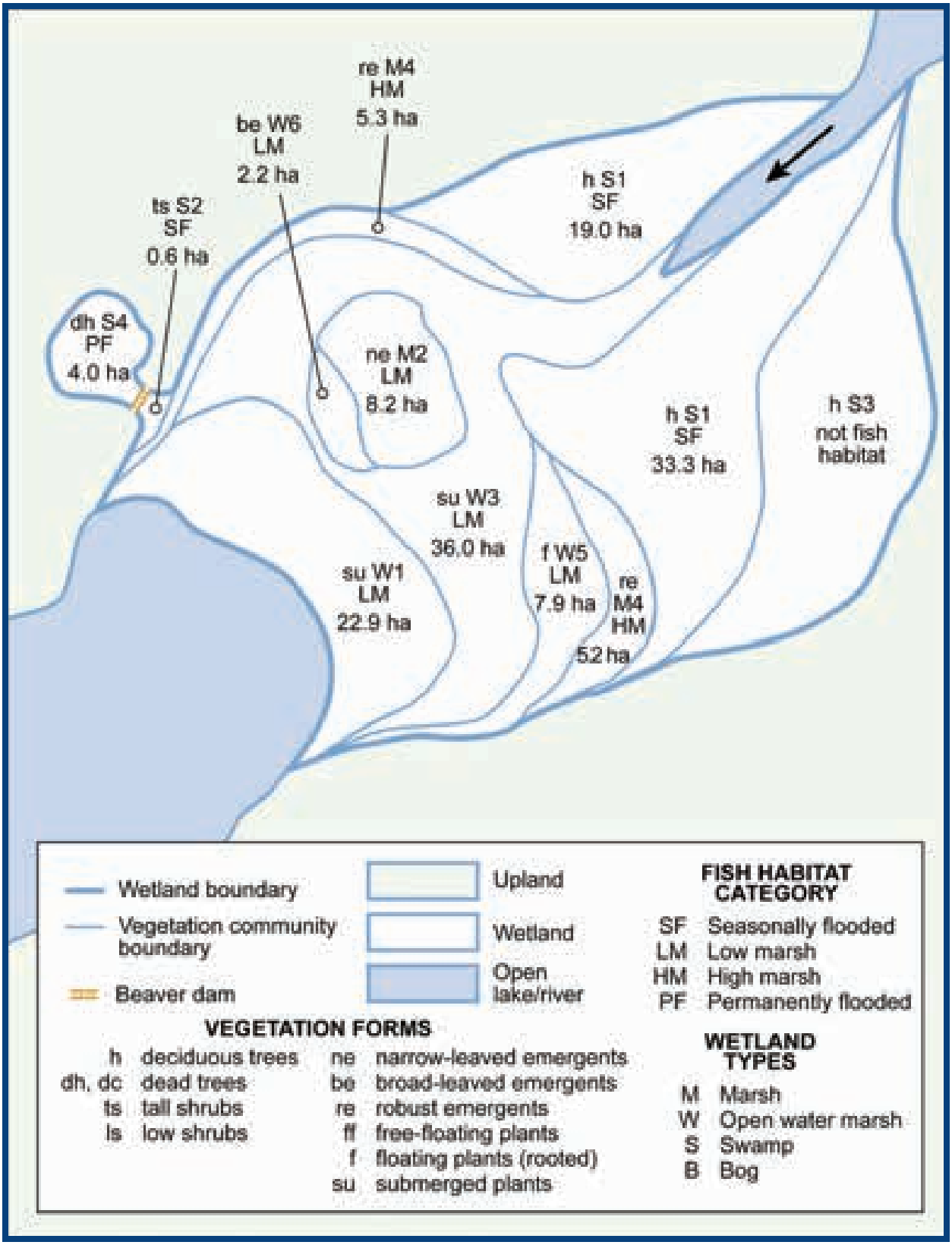


Figure 23: Example of a wetland being assessed for spawning and nursery habitat

During the standard mapping of the wetland vegetation communities (Section 1.2.2), two plant species are recorded for each vegetation form. It is very important to note that, if spawning and nursery habitat are to be based on habitat assessment, the most abundant species of the dominant vegetation form must be identified. For example:

W3 su(*), f ***Potamogeton nodosus,*** *Elodea canadensis;* f; *Potamogeton natans, Nymphaea odorata*

In this open water marsh community, su is the dominant form, and Potamogeton nodosus is the most abundant species. To determine which Vegetation Group Potamogeton nodosus falls into, refer to Appendix 7, which breaks plant species into 12 broad groups. Potamogeton nodosus is considered to be a Broad-leaf pondweed, Group 12. The same process is followed with each marsh vegetation community.

The areas of the vegetation communities representing the same Vegetation Group from Appendix 7 are then added. For example, in Table 9, communities W1 and W3 both represent Group 12. The areas of W1 and W3 are added and entered on the scoring chart. Note that areas for Low Marsh and High Marsh must be calculated separately. A size factor, determined from Table 7, is applied to the total area of Low Marsh, High Marsh, Seasonally Flooded Swamp and Permanently Flooded Swamp. An example of the scoring based on the wetland in Figure 23 is shown below.

Table 9: Summary of Fish Habitat Present in Wetland (shown in Figure 23)

Community Code	Dominant Form	Dominant Species	Vegetation Group (refer to table in Appendix 7)	Size (ha)
Low Marsh				
W1	su	*Potamogeton amplifolius*	12	22.9
M2	ne	*Zizania palustris*	1	8.2
W3	su	*Potamogeton nodosus*	12	36.0
W5	f	*Nymphaea odorata*	7	7.9
W6	be	*Pontederia cordata*	4	2.2
High Marsh				
M4	re	*Typha latifolia*	3	10.5
Permanently flooded swamp containing fish habitat				
S4	n/a	n/a	n/a	4.0
Seasonally flooded swamp containing fish habitat				
S1	n/a	n/a	n/a	52.3
S2	n/a	n/a	n/a	0.6

EVALUATION:

STEP 1:

_____	Fish habitat is not present within the wetland	Go to Step 7, Score 0 points
__x__	Fish habitat is present within the wetland	Go to Step 2

STEP 2: *Choose only one option*

_____	Significance of the spawning and nursery habitat within the wetland is known	Go to Step 3
__x__	Significance of the spawning and nursery habitat within the wetland is not known	Go through Steps 4, 5 and 6

STEP 3: *Select the highest appropriate category below, attach documentation:*

_____	Significant in Ecoregion	Go to Step 7, Score 100 points
_____	Significant in Ecodistrict	Go to Step 7, Score 50 points
_____	Locally Significant Habitat (5.0+ ha)	Go to Step 7, Score 25 points
_____	Locally Significant Habitat (<5.0 ha)	Go to Step 7, Score 15 points

STEP 4:

Low Marsh = the '*permanent*' marsh area, from the existing water line out to the outer boundary of the wetland.

_____	Low marsh not present	Go to Step 5
__x__	Low marsh present	Continue through Step 4, scoring as noted below

Scoring of Low Marsh:

a. Check the appropriate **Vegetation Group** (see Appendix 7) for each Low Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each Low Marsh vegetation community.)
b. Sum the areas (ha) of the vegetation communities (listed in Table 9) assigned to each **Vegetation Group**.
c. Use these areas to assign an **Area Factor** (from Table 7) for each checked **Vegetation Group**.
d. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate Score.
e. Sum all numbers in Score column to get **Total Score** for **Low Marsh**.

Table 10: Scoring for Presence of Key Vegetation Groups – Low Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
1	Tallgrass	x	8.2	0.4	6	2.4
2	Shortgrass-Sedge				11	
3	Cattail-Bulrush-Burreed				5	
4	Arrowhead-Pickerelweed	x	2.2	0.2	5	1.0
5	Duckweed				2	
6	Smartweed-Waterwillow				6	
7	Waterlily-Lotus	x	7.9	0.4	11	4.4
8	Waterweed-Watercress				9	
9	Ribbongrass				10	
10	Coontail-Naiad-Watermilfoil				13	
11	Narrowleaf Pondweed				5	
12	Broadleaf Pondweed	x	58.9	1.0	8	8.0
	Total Score for Low Marsh *(maximum 75 points)*					16
	Continue to Step 5					

STEP 5:

High Marsh = the 'seasonal' marsh area, from the water line to the inland boundary of marsh wetland type. This is essentially what is commonly referred to as a wet meadow, in that there is insufficient standing water to provide fisheries habitat except during flood or high water conditions.

_____	High marsh not present	Go to Step 6
___x___	High marsh present	Continue through Step 5, scoring as noted below

Scoring of High Marsh:

a. Check the appropriate **Vegetation Group** (see Appendix 7) for each High Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each High Marsh vegetation community.)
b. Sum the areas (ha) of the vegetation communities (listed in Table 9) assigned to each **Vegetation Group**.
c. Use these areas to assign an **Area Factor** (from Table 7) for each checked Vegetation Group.
d. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate **Score**.
e. Sum all numbers in Score column to get **Total Score for High Marsh**.

Table 11: Scoring for Presence of Key Vegetation Groups – High Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
1	Tallgrass				6	
2	Shortgrass-Sedge				11	
3	Cattail-Bulrush-Burreed	x	10.5	0.6	5	3.0
4	Arrowhead-Pickerelweed				5	
	Total Score for High Marsh *(maximum 25 points)*					3
	Continue to Step 6					

STEP 6:

Swamp: Swamp communities containing fish habitat, either seasonally or permanently. Determine the total area of seasonally flooded swamps and permanently flooded swamps containing fish habitat.

_____	Swamp containing fish habitat not present	Go to Step 7
_x_____	Swamp containing fish habitat present	Continue through Step 6, scoring as follows

Scoring of Swamp:

a. Determine the total area (ha) of seasonally flooded swamp communities within the wetland containing fish habitat and record in Table 13.
b. Determine the total area (ha) of permanently flooded swamp communities within the wetland containing fish habitat and record in Table 13.
c. Use these areas to assign an **Area Factor** (from Table 7).
d. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate **Score**.
e. Sum all numbers in **Score** column to get **Total Score for Swamp**.

Table 12: Scoring Swamps for Fish Habitat (Seasonally Flooded; Permanently Flooded)

Swamp Containing Fish Habitat	Present (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
Seasonally Flooded Swamp	x	52.9	1.0	10	10
Permanently Flooded Swamp	x	4.0	0.2	1	2
		Total Score for Swamp *(maximum 20 points)*			12

Continue to Step 7

STEP 7:

CALCULATION OF FINAL SCORE:

NOTE: Scores for Steps 4, 5 and 6 are only recorded if Steps 1 and 3 have not been scored.

A.	Score from Step 1 (fish habitat not present)	=	n/a
B.	Score from Step 3 (significance known)	=	n/a
C.	Score from Step 4 (Low Marsh)	=	16
D.	Score from Step 5 (High Marsh)	=	3
E.	Score from Step 6 (Swamp)	=	12

Calculation of Final Score for Spawning and Nursery Habitat = A or B or Sum of C, D, and E: 31

Score for Spawning and Nursery Habitat *(maximum score 100 points)*

4.2.7.2 Migration and Staging Habitat

The second fish habitat value that is assessed is migration and staging habitat. Again, two methods of assessment are possible, based on the available knowledge of the value of the wetland for providing these habitats. If fish migration and/or staging habitat is present and the significance of the wetland is known assessment is based on the relative importance of the wetland at a Ecoregion, Ecodistrict and local level. Wetlands with fish habitat significant at the Ecoregion level may be those that contain one or more unique characteristics pertaining to the fish species or populations using the wetland. For example, if the wetland provides a staging area and/or migration route critical to a significant population of fish it could be significant at the Ecoregion level. Similar criteria may be applied to fish habitat significant at an Ecodistrict level.

If fish migration and/or staging habitat is present but the level of significance is not known, assessment is based upon the presence of designated site types.

EVALUATION:

STEP 1:

_____	Staging or Migration Habitat is not present in the wetland	Go to Step 4, Score 0 points
_____	Staging or Migration Habitat is present in the wetland, significance of the habitat is known	Go to Step 2
_____	Staging or Migration Habitat is present in the wetland, significance of the habitat is not known	Go to Step 3

STEP 2: *Select the highest appropriate category below. Ensure that documentation is attached to the data record.*

_____	Significant in Ecoregion	Score 25 points in Step 4
_____	Significant in Ecodistrict	Score 15 points in Step 4
_____	Locally Significant	Score 10 points in Step 4
_____	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

STEP 3: *Select the highest appropriate category below based on presence of the designated site type (i.e. does not have to be the dominant site type). Refer to Site Types recorded earlier (section 1.1.3). Distance is measured as the shortest straight line ("as the crow flies"). Attach documentation.*

_____	Wetland is riverine at rivermouth or lacustrine at rivermouth	Score 25 points in Step 4
_____	Wetland is riverine, within 0.75 km of rivermouth	Score 15 points in Step 4
_____	Wetland is lacustrine, within 0.75 km of rivermouth	Score 10 points in Step 4
_____	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

STEP 4: *Enter a score from only one of the three above Steps.*

Score for Staging and Migration Habitat *(maximum score 25 points)*_____

4.3 ECOSYSTEM AGE

Photo: Rebecca Zeran

Old ecosystems have special or unique value in that they are living representative examples of the time-tested ecological norms of our planet. In such places ecosystem processes can proceed relatively unimpeded by human intervention.

Ecosystem age is an important factor in the evaluation because certain wetland types can take thousands of years to develop. Ecosystem age recognizes that some wetland types are valued because their natural restoration time is very long. This assessment assumes that the intrinsic value of a wetland can be measured in part by the amount of time and cost that would be required to replace it.

Of the four wetland types, bogs generally represent the greatest state of ecosystem age followed by fens, swamps and marshes. Destruction of a bog ecosystem (including the removal of its accumulated deposits of peat) would leave many bog species without habitat to sustain them. Since the replacement of the peat in a bog can take many thousands of years, these species could be locally extirpated. In contrast, a marsh could re-establish and provide productive marsh habitat in a matter of years or decades.

This evaluation assumes that fens on open limestone rock (or extremely shallow soils) can develop over a short period of time, assuming that fen species were available for colonization. Fens on limestone rock are characteristic of some shorelines on Manitoulin Island.

On the basis of the above considerations, ecosystem age is evaluated by wetland type.

EVALUATION: (FA = fractional area)

Bog	=	FA x 25
Fen, on deeper soils; floating mats or marl	=	FA x 20
Fen, on limestone rock	=	FA x 5
Swamp	=	FA x 3
Marsh	=	FA x 0

(maximum score 25 points)

4.4. GREAT LAKES COASTAL WETLANDS

Coastal wetlands along the Great Lakes and St. Lawrence River provide significant value to Ontario, including valuable habitat for fish and wildlife habitat areas, and opportunities for recreation. In addition, protection and rehabilitation of coastal wetlands and the values they provide is the are the focus of international conservation efforts through vehicles such as the Great Lakes Water Quality Agreement under the International Joint Commission, the Great Lakes Wetland Conservation Action Plan, and the Great lakes Commission. In recognition of the value of these wetlands as an international resource, this section assigns a score to them based on their size. Note that the value being scored is the coastal nature of the wetland.

A 'coastal' wetland is defined as follows (modified from the Strategic Plan for Wetlands in the Great Lakes Basin):

1. any wetland that is on the Great Lakes (Lakes Ontario, Erie, Huron, and Superior) or their connecting channels (Lake St. Clair, St. Mary's, St. Clair, Detroit, Niagara, and St. Lawrence Rivers), OR

2. any wetland that is on a tributary to the Great lakes or their connecting channels (see #1 above) and lies, either wholly or in part, downstream of a line located 2 km upstream (as 'the crow flies') of the 1:100 year floodline (plus wave run-up) of the large water body to which it is connected.

If the 1:100 year floodline is not known, use a line 2 km from the shore of the Great Lake, connecting channel or defined major river as the defining boundary. In other words wetlands on tributaries located within 2 km of one of the defined water bodies are to be considered "coastal".

EVALUATION

Choose one only

Wetland < 10 ha	=	10 points
Wetland 10-50 ha	=	25
Wetland 51-100 ha	=	50
Wetland > 100 ha	=	75

(maximum score 75 points)

5.0 REFERENCES CITED

Bullfrog Photo: Rebecca Zeran

Adamus, P.R. and L.T. Stockwell. 1983. A Method for Wetland Functional Assessment. Vol. 1 & 2. Report FWHA-1P-82-23. (U.S. Federal Administration).

Bay, R.R. 1969. Runoff from Small Peatland Watersheds. J. Hydrology. 9:90-102.

Bertulli, J.A. 1981. Influence of a Forested Wetland on a Southern Ontario Watershed. Proc. of the Ontario Wetland Conf., Fed. of Ont. Naturalists, Don Mills, Ontario, pp.33-48.

Black, C.C. *et al.* 1990. Loss of Biological Diversity: Global Crisis Requiring International Solutions. Committee on International Science's Task Force on Global Diversity. National Science Foundation, Washington, D.C. 19 pp.

Brown, D.M., J.L. Chapman, and G.A. Chapman. 1968. The Climate of Southern Ontario. Climatalogical Studies No. 5. 50 pp.

Cadman, M.D., P.F.J. Eagles, F.M. Helleiner. 1987. Atlas of the Breeding Birds of Ontario. University of Waterloo Press.

Calhoun, A.J.K., N. Miller, and M. W. Klemens. 2005. Conservation strategies for pool-breeding amphibians in human-dominated landscapes. Wetlands Ecology and Management 13:291-304. Canadian Lakes Loon Survey Co-ordinated by Long Point Bird Observatory Port Rowan, Ontario

Carter, V. 1986. An Overview of the Hydrologic Concerns Related to Wetlands in the United States. Can. J. Bot. 64: 364-374.

Carter, V., M.S. Bedinger, Richard P. Novitzki, and W.O. Wilen. 1978. Water Resources and Wetlands. In Wetland Functions and Values: The State of our Understanding. American Water Resources Association.

Colburn, E. A. 2004. Vernal Pools: Natural History and Conservation.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LarRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, U.S. Dept. Interior, Washington, D.C.. 103 pp.

Crins, William J., Paul A. Gray, Peter W.C. Uhlig, and Monique C. Wester. 2009. The Ecosystems of Ontario, Part I: Ecozones and Ecoregions. Ontario Ministry of Natural Resources, Peterborough Ontario, Inventory, Monitoring and Assessment, SIB TER IMA TR- 01, 71pp.

Dai, T.S. V.S. Haavisto and J.H. Sparling. 1974. Water Level Fluctuation in a Northern Ontario Peatland. Canadian J. For. Res., 4:76-81

Damman, A.W.H., and T.W. French. 1987. The Ecology of Peat Bogs of the Glaciated Northeastern United States, A Community Profile. U.S. Dept. Int., Fish and Wildlife Service, Washington, D.C. 101 pp.

de Groot, R.S. 1986. A Functional Ecosystem Evaluation Method as a Tool in Environmental Planning and Decision Making. Nature Conservation Department, Agriculture University, Wageningen, The Netherlands. 38 pp.

Devito, K.J., P.J. Dillon and B.D. Lazerte. 1989. Phosphorous and Nitrogen Retention in Five Precambrian Shield Wetlands. Biogeochemistry 8:185-204.

Edey, S.N. 1977. Growing Degree Days and Crop Production in Canada. Canada Dept. of Agriculture, Publication No. 1635. 63 pp.

Environment Canada, Atmospheric Environment Service. 1982. Canadian Climate Normals, Volume 4, Degree Days, 1951-1980. 280 pp.

Environment Canada and Ministry of Natural Resources. 1984. An Evaluation System for Wetlands of Ontario South of the Precambrian Shield. 169 pp.

Environment Canada 1987. The Canadian Wetland Classification System. Ecological Land Classification Series No. 21. Lands Conservation Branch, Canadian Wildlife Service, Ottawa. 18 pp.

Gehrels, J., and G. Mulamoottil. 1990. Hydrological Processes in a Southern Ontario Wetland. Hydrobiologia 208:221-234.

Glasser, P.H., J.A. Jansssens, and D.I. Siegel. 1990. The response of Vegetation to Chemical and Hydrological Gradients in the Lost River Peatland, Northern Minnesota. J. Ecol. 78:1021-1048.

Golet, F.C. 1976. Wildlife Wetland Evaluation Model. In Models for the Evaluation of Freshwater Wetlands. J.S. Larson (ed.). Water Resources Research Centre, University of Massachusetts. 13-34 pp.

Gore, A.J.P. (ed.). 1983. Mires, Swamps, Bog, Fen, and Moor. Analytical Studies. Elsevier, Amsterdam. 483 pp.

Gorham, R.E. 1991. The Role of Northern Peatlands in the Carbon Cycle, and their Probable Responses to Climatic Change. Ecological Applications 1:182–195.

Gosselink, J.C. and R.E. Turner. 1978. The Role of Hydrology in Freshwater Wetland Ecosystems. In Freshwater Wetlands: Ecological Processes and Management Potential. Good R.E., D.F. Whigman, and R.L. Simpson (eds.), Academic Press, New York. 63-78 pp.

Greeson, P.E., J.R. Clark and Judith E. Clark. 1979. Wetland Functions and Values. The State of Our Understanding. Proc. Nat. Symp. on Wetlands. American Water Resources Association, Minneapolis. 674 pp.

Harris, A.G., S.C. McMurray, P.W.C. Uhlig, J.K. Jeglum, R.F. Foster, and G.D. Racey. 1996. Field guide to the wetland ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources., Northwest Science and Technology Thunder Bay, Ont. Field Guide FG-01. 74 pp. plus appendices

Hill, A.R., and J. Warwick. 1987. Ammonium Transformation in Springwater within the Riparian Zone of a Small Woodland Stream. Can. J. Fish. Aquat. Sci. 44:1938-1956.

Hill, A.R. 1990. Groundwater Flow Paths in Relation to Nitrogen Chemistry in Near-stream Zone. Hydrobiologia 206:39-52.

Hills, G.A. 1959. A Ready Reference to the Description of the Land of Ontario and its Productivity: A Compendium of Maps, Charts, Tables, and Brief Comments. Division of Research, Ontario Department of Lands and Forests, Maple, Ont. 142 pp.

Hills, G.A. 1961. The Ecological Basis for Land-use Planning. Research Report No. 64. Research Branch, Ontario Department of Lands and Forests, Maple, Ont. (reprinted in 1966 with updated maps).

Holland, M.M., D.F. Whigham, and B. Gopal. 1990. The Characteristics of Wetland Ecotones, In Ecology and Management of Aquatic-terrestrial Ecotones. Naiman, R.J., and H. Decamps (eds.) Parthenon Publishing Group Ltd., Carnforth, U.K.

Hynes, H.B.N. 1970. The Ecology of Running Water. University of Toronto Press, Toronto, Ontario. 555 pp.

Ivanov, K.E. 1981. Water Movement through Mirelands. Academic Press, New York. 276 pp.

Janecek, Joseph A. 1988. Literature review on fishes interactions with aquatic macrophytes with special reference to the Upper Mississippi River system. Upper Mississippi River Conservation Committee, Fisheries Section. Rock Island, Illinois. 57 pp.

Jeglum, J.K., A.N. Boissoneau, and V.F. Haavisto. 1974. Toward a Wetland Classification for Ontario. Information Report O-X-215. Canadian Forestry Service, Department of the Environment, Ottawa. 54 pp. and Appendices.

Johnson, C.A., and R.J. Naiman. 1987. Boundary Dynamics at Aquatic-terrestrial Interface: The Influence of Beaver and Geomorphology. Landscape Ecology 1:47-57.

Johnston, C.A., N.E. Detenbeck, and G.J. Niemi. 1990. The Cumulative Effect of Wetlands on Stream Water Quality and Quantity. A Landscape Approach. Biogeochemistry 10:105-141.

Kadlec, R.H., D.E. Hammer, I.S. Nam and J.S. Wilkes. 1981. The Hydrology of Overland flow in Wetlands. Chem. Eng. Commun. 9:331-334.

Kolozsvary, M.B. and R.K. Swihart. 1999. Habitat fragmentation and the distribution of amphibians: patch and landscape correlates in farmland. Can. J. Zool. 77: 1288-1299.

Lee, Harold. (2007). DRAFT: Ecosystems of Ontario: Field Reference for Southern Ontario Applications: Standards for Describing and Classifying Ecosystems in the Field. Ministry of Natural Resources.

Lee, H., W. Bakwosky, J. Riley, J. Bowles, M. Puddister, P Uhlig, and S. McMurray. 1998. ELC for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Leith, H. and R.H. Whittaker (eds.). 1975. Primary Productivity of the Biosphere. Springer/Verlag, N.Y., Heidelberg, Berlin. 339 pp.

Malmer, N. 1986. Vegetation Gradients in Relation to Environmental Conditions in Northwestern European Mires. Can. J. Bot. 64:375-383.

McGraw Hill. 1974. Dictionary of Scientific and Technical Terms.

McNeely, J.A., K.R. Miller, W.V. Reid, R.A. Mittermier and T.B. Werner. 1990. Conserving the World's Biological Diversity. IUCN. 153 pp.

Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders, Philadelphia. 574 pp.

Ontario Biodiversity Council. 2011. Ontario's Biodiversity Strategy, 2011: Renewing Our Commitment to Protecting What Sustains Us. Ontario Biodiversity Council, Peterborough, ON. 69 pp.

Ontario Institute of Pedology. 2003. Field manual for describing soils in Ontario. Fourth Edition. Compiled by K.A. Denholm and L.W. Schut. Prepared by D.E. Irvine Ontario Institute of Pedology, Guelph Ontario. Published by Land Resource Science, University of Guelph. ISBN 0-88955-340-8

Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide. 139 p + appendices.

Ontario Ministry of Natural Resources (OMNR). 2002. Ontario Wetland Evaluation System: Northern Manual. Wildlife Policy Branch, Toronto, Ontario.

Ontario Ministry of Natural Resources (OMNR). 2007. Forest Management Guide for Cultural Heritage Values. OMNR, Queen's Printer for Ontario, Toronto. 84 pp.

Ontario Ministry of Natural Resources (OMNR). 2007. Technical Guideline for Cultural Heritage Resources for Projects Planned under the Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects and the Class Environmental Assessment for Provincial Parks and Conservation Reserves. 20 pp + appendices.

Ontario Ministry of Natural Resources (OMNR). 2009. Ecological Land Classification Field Manual – operational draft, April 20th, 2009. Ecological Land Classification Working Group. Ont. Min. Natur. Resour. Unpublished manual.

Ontario Ministry of Natural Resources (OMNR). 2012. Ontario Invasive Species Strategic Plan. 58pp.

Ontario Ministry of Tourism and Culture. 2010. Standards & Guidelines for Conservation of Provincial Heritage Properties 13 pp + appendices.

Phillips, J.D. 1989. Fluvial Sediment Storage in Wetlands. Water Resources Bulletin 25:867-973.

Price, J.S. 1991. Evaporation from a Blanket Bog in a Foggy Coastal Environment. Boundary Layer Meteorol. 57: 391-406.

Price, J.S. 1992. Blanket bog in Newfoundland. Part 2. Hydrological processes. J. Hydrol. In Press.

Price, J.S., D.A. Maloney, and F.G. Downey 1990. Peatlands of the Lake Melville Coastal Plain, Labrador. in Northern Hydrology: Selected Perspectives. T.D. Prowse and C.S.L. Ommaney. (eds.), NHRI Symposium No. 6, Environment Canada, Saskatoon, 293-302.

Price, J.S. and M.K. Woo. 1988. Studies of a Subarctic Coastal Marsh. I. Hydrology. Journal of Hydrology, 103:275-292.

Richardson, C. 1978. Primary Productivity Values in Fresh Water Wetlands. In Wetland Functions and Values: the State of our Understanding. P.E. Greeson, J.R. Clark and J.E. Clark (eds.). Proc. Nat. Sym. on Wetlands. American Water Resources Association. Minneapolis, Minnesota. pp. 131-145.

Richardson, J.L and M.J. Vepraskas. 2001. Wetland Soils: Genesis, Hydrology, Landscapes and Classification. CRC Press, Boca Raton, FL. 417 pp.

Riley, J.L. 1983. Keys to Wetland Classification used by the Peatland Inventory Project in Southern Ontario. Appendix to: Specifications for the Peatland Inventory Project. Ontario Geological Survey. Unpublished. M.S.

Riley, J.L. 1987. Peat and Peatland Resources of Northeastern Ontario; Ontario Geological Survey, Open File Report 5631, 261 pp., 8 figures, 11 tables, 12 photos, 6 appendices, 1 chart, and 5 maps in back pocket.

Riley, J.L. 1988. Peat and Peatland Resources of Southeastern Ontario; Ontario Geological Survey, Open File Report 5633, 283 pp., 8 figures, 11 tables, 12 photos, 6 appendices, 1 chart, and 5 maps in back pocket.

Riley J.L., and S.M. McKay. 1980. Vegetation and Phytogeography of Coastal Southwestern James Bay. Royal Ontario Museum Life Sciences Contributions No. 124, 81 pp.

Riley, J.L. and L. Michaud. 1987. Peat and Peatland Resources on Northwestern Ontario. Ontario Geological Survey, Open file Report 5632.

Riley, J.L. and L. Michaud. 1989. Peat and Peatland Resources on Northwestern Ontario. Ontario Geological Survey, Miscellaneous paper 144, Ministry of Northern Development and Mines, Ontario. 175 pp. and maps.

Riley, J.L. Peat and Peatland Resources of Southeastern Ontario, Miscellaneous Paper 154. Ontario Geological Survey, Ministry of Natural Resources. Queen's Printer 1994.pp 1-167

Roulet, N.T. 1989. Groundwater Flux in a Headwater Wetland in Southern Ontario, In Ontario Wetlands: Inertia or Momentum, Bardecki, M.J. and N. Patterson (eds.), Federation of Ontario Naturalists, Don Mills, Ontario. 301-308 pp.

Roulet, N.T. 1990a. Hydrology of Peat-covered Wetlands. Canadian Geographer 34:78-90.

Roulet, N.T. 1990b. Hydrology of a Headwater Basin Wetland. Groundwater Discharge and Wetland Maintenance. Hydrological; Processes 4:387-400.

Rowe, J.S. 1961. The Level of Integration Concept and Ecology. Ecology 42:420-427.

Rowe, J.S. 1990. Home Place, Essays on Ecology. NeWest Publishers, Edmonton and Canadian Parks and Wilderness Society, Toronto, 253 pp.

Siegel, D.I. 1988. A Review of the Recharge-Discharge Functions of Wetlands, In Ecology and Management of Wetlands, Hook, *et al*. (eds.), Croom Helm ltd. 61-69 pp.

Siegel, D.I. and P.H. Glasser. 1987. Groundwater Flow in a Bog-Fen Complex, Lost River Peatland, Northern Minnesota. J. Ecol. 75:743-754.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Research Branch, Agriculture and Agri-Food Canada, Publication 1646, 3rd Edition. NRC Press .

Soils and Substrates Ontario Working Group. In prep. Field manual for describing site, soils, and substrates in Ontario. University of Guelph, Agriculture Canada, Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Ministry of Natural Resources.

Sorensen, E.R. 1986. The Ecology and Distribution of Patterned Fens in Maine and their Relevance to the Critical Areas Program. Maine State Planning Office, Planning Report 81. 159 pp.

Urban, N.R., and S.J. Eisenriech. 1988. Nitrogen Cycling in a Forested Minnesota Bog. Can. J. Bot. 66:435-449.

Vannote, R.L.G., G.W. Minshall, K.W. Cummins, J.R. Sedell and C.E. Cushing, 1980. The River Continuum Concept. Can. J. Fish. Aquatic. Sci. 37:130-137.

Verry, E.S. 1988. The Hydrology of Wetlands and Man's Influence on them. Proc. Int. Symp. of the Hydrology of Wetlands in the Temperate and Cold Regions. The Academy of Finland, Helsinki. 2:41-61.

Verry, E.S., K.N. Brooks, and P.K. Barten. 1988. Streamflow Response from an Ombrotrophic Mire. Proc. Int. Symp. of the Hydrology of Wetlands in Temperate and Cold Regions, The Academy of Finland, Helsinki. 1:52-59.

Williams, D. D. 2006. The Biology of Temporary Waters. Oxford University Press. 348pp.

Winter, T.C. 1988. A Conceptual Framework for Assessing Cumulative Impact on the Hydrology of Nontidal Wetlands. Env. Manage. 12:605-620.

Whigham, D.F. and S.E. Bayley. 1978. Nutrient Dynamics in Freshwater Wetlands. In Wetlands Functions and Values: The State of our Understanding. Greedon, P.E., J.R. Clark, and J.E. Clark (eds.). American Water Resources Association. 478-488 pp.

Whiteley, H.R. and R.W. Irwin. 1986. The hydrological response of wetlands in southern Ontario. Canadian Water Resources Journal 11(1):100-109.

Woo, M.K. and J. Valverde. 1981. Summer Streamflow and Water Level in a Mid-latitude Swamp. Forest Sci. 27:177-189.

Zoltai, S.C., F.C. Pollet, J.K. Jeglum and G.D. Adams. 1975. Developing a Wetland Classification For Canada, In Proc. 4th N.A. Forest Soils Conf. B. pp. 479-511.

GLOSSARY

Accuracy: in a GIS context a measure of the absence of positional and/or thematic errors, essentially defines how close a thematic class and/or spatial location is to its true value and/or spatial location.

ANSI: Area of Natural and Scientific Interest

Attenuation: An exponential reduction in amplitude, density, or energy as a result of such effects as absorption, scattering, or friction.

Aquifer: A permeable formation capable of storing and transmitting underground water.

Barrier Beach: A sand and/or gravel ridge formed parallel to a coast in shallow water.

Biodiversity: See Biological Component, Biodiversity Section 1.2.

Biomass: The dry weight of living matter expressed in terms of a given area or volume.

Bog: see Biological Component, Section 1.2.2.

Broad-leaved Emergents (be): Broad-leaved, non-woody herbaceous plants which may be temporarily or permanently flooded at the base but are exposed at the upper portion and typically are less than 1.5 metres in height.

Brown Mosses: Various species of mosses specific to fens which have a narrow range of pH tolerance.

Calcareous: Resembling, containing, or composed of calcium carbonate.

Catchment: See drainage basin.

Channelization: An arrangement that directs the flow of water into streams, limiting or preventing movements from one stream to another. Channelization usually results in artificial straightening of the stream channel and modification of the natural streambank.

Clay: A rock or mineral fragment of extremely small size usually defined as having a diameter of less than .0039mm.

Coastal Wetland: 1. any wetland that is on the Great Lakes (Lakes Ontario, Erie, Huron and Superior) or their connecting channels (Lake St. Clair, St Mary's, St. Clair, Detroit, Niagara, and St. Lawrence Rivers) OR, 2. any wetland that is on a tributary to the Great Lakes or their connecting channels and lies, either wholly or in part, downstream of a line located 2 km upstream (as 'the crow flies') of the 1:100 year floodline (plus wave run-up) of the large water body to which it is connected.

Cobble: Smoothly rounded rock fragments between 8 and 25 cm in size.

Colonial Waterbirds: A localized population of the same species nesting in close proximity to each other.

Connecting Channel: A major watercourse connecting one Great Lake to another. Refers to Lake St. Clair, St. Mary's River, St. Clair River, Detroit River, Niagara River, and St. Lawrence Rivers (See Section 4.4)

Cover: The area of ground covered or the relative proportion of coverage a particular plant species.

- Absolute Cover: The proportion of the ground area, expressed as a per cent, shaded by a particular plant species, vegetation layer or plant form.
- Relative Cover: The proportion of the total vegetation cover that a particular species, vegetation layer or plant form, represents.

Crown Land: Land owned by the provincial or federal government.

DBH: Diameter at Breast High, i.e. diameter at 1.2 m (4 ft.) from the ground.

DEM: Digital Elevation Model

Detention Area: A surface water feature that retains water for some period of time and may protect land against flooding and in some cases downstream erosion. Detention areas can include other wetlands and open water areas such as lakes, larger rivers, resevoirs, ponds, flooded pits or quarries.

Detritivores: Organisms which feed on freshly dead or partially decomposed organic matter.

Discharge, Groundwater: See Hydrological Component Section 3.6.

Drainage Basin: An area occupied by a closed drainage system, especially a region that collects surface runoff and contributes it to a stream channel, lake or other body of water. Also known as Catchment or Watershed.

Ecodistricts: smaller then ecoregions, ecodistricts are defined by subregional patterns of surficial geology, bedrock geology, and topography, that influence vegetation distribution and productivity.

Ecoregions: smaller than ecozones, these are areas of the landbase defined by broad regional climatic regimes (e.g., temperature, precipitation, and humidity) that influence vegetation distribution and productivity.

Ecosystem: A biological community and its pattern of interaction within the environment. Ecosystems exist at many scales, from microscopic to the entire biosphere.

Ecotone: The transitional zone between two overlapping or adjacent vegetation communities.

Ecozones: major geographic divisions of the landscape that separate coarse-scale enduring features (such as bedrock zonation). There are 3 ecozones in Ontario: Hudson Bay Lowlands, Ontario Shield, and Mixedwood Plains.

EFRI: Enhanced Forest Resource Inventory

ELC: Ontario's Ecological Land Classification system

Element: Refers to an element of biodiversity: species (including sub-species, varieties and hybrids) and natural communities.

Element Occurence: refers to an occurrence of an element of biodiversity on the landscape; an area of land and/or water on/in which an element (e.g. species or ecological community) is or was present.

Emergents: Herbaceous plants which rise out of the water.

Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA. Listed as Endangered on the Species at Risk in Ontario List.

EO: See Element Occurence.

Ephemeral Pools: Pools which exist only for a short time i.e. a few days or a few weeks.

Ericaceous Shrubs: Woody shrubs in the family Ericaceae.

Eutrophic Water: Water rich in nutrients with abundant plankton.

Evaluated Wetland: A term used to describe a wetland where wetland vegetation communities are a single unit, and have been evaluated under the OWES and given a common name and significance rank.

Evapotranspiration: The loss of water from land surfaces to the atmosphere by evaporation and by transpiration from plants.

Exacting Mosses: Mosses which have specific pH requirements.

Extirpated: A species that no longer exists in the wild in Ontario but still occurs elsewhere. Listed as Extirpated on the Species at Risk in Ontario List.

Fauna: Animals, including invertebrates.

Floating Plants (f): Rooted, vascular hydrophytes with leaves floating horizontally on or just above the water surface.

Fen: See Biological Component, Section 1.1.2.

Fish Habitat: See Special Feature Component 4.2.7

Flood Attenuation: See Hydrological Component 3.1.

Flora: Plants, including lower plants.

Forage Fish: The lower trophic levels of a community of fish. Species upon which the predatory species of fish feed.

Free-floating Plants (ff): Non-rooted, hydrophytes floating on or just below the water surface.

GIS: Geographic Information System

Graminoid Plants: Grass-like in appearance, includes grasses, sedges and some rushes.

Grasses: The common name for all members of the family Gramineae and Poaceae, monocotyledonous plants having leaves that consist of a sheath which fits around the stem like a split tube, and a long narrow tube. See sedge and graminoid.

Gravel: A sediment of stones between 0.2 and 3cm in size formed by the action of moving water, usually mixed with finer particles.

Greenhouse Gas: A term for a gas such as carbon dioxide or methane that increases global temperatures by trapping solar infrared radiation.

Groundcover (gc): Non-woody (herbaceous) plants growing in moist but exposed soil or, occasionally, very shallow water. Includes ferns.

Groundwater: The zone of water saturation in the soil, the top being the water table.

Growing Degree Days: The growing degree-day concept provides an assessment of the suitability of the temperature conditions for plant growth. Each degree Celsius above 5 is considered as one degree-day. Annual growing degree-day values are obtained by adding the differences between 5° C and the mean daily temperature for each day of the year that the mean temperature is above 5° C.

Herbarium: A collection of plant specimens, pressed and mounted on paper or placed in liquid preservatives, and systematically arranged with identifying labels.

Herbivore: An organism that feeds on plants, especially an animal whose diet is exclusively plants.

High Marsh: For the purpose of this evaluation, high marsh is defined as the area from the water line to the inland boundary of marsh wetland type. This is essentially what is commonly referred to as a wet meadow, in that there is insufficient standing water to provide fisheries habitat except during flood or high water conditions.

Hummock: A conical or rounded, usually equidimensional mound, hillock, or other small elevation.

Hunter Days: A standard measure for comparison of recreational hunting. One hunter-day equals 3 hours of hunting by one individual.

Hydric: For wetland evaluation purposes, hydric substrates are characterized by:

- rock, mineral or organic substrates with an ELC Moisture Regimes (MR) of ≥ 6, 7, 8, 9; or
- saturated rock, mineral or organic substrates (ELC category "s"); or
- an ELC MR of 5 (i.e, near-hydric), considered "moist" which may support hydrophytic or water-tolerant vegetation

Hydrology: The science of water, its properties and laws, and its distribution over the earth's surface.

Hydrophilic: Having an affinity for water. Attracting, absorbing or living in water.

Hydroperiod: the seasonal pattern of the water level in a wetland.

Hydrophyte: Plant species suited to growth in water or saturated soil conditions.

Indigenous: Existing and having originated naturally in a particular region or environment.

Intermittent Streams: Streams, creeks, or drainage courses which flow only part of the year, or at intervals throughout the year.

Interspersion: The measure or degree of edge contact, or ecotone length that exists between adjacent vegetation communities.

Iron Precipitate: These are formed when reduced forms of iron in groundwater come into contact with the oxygenated surface environment of a wetland. The iron precipitates appear on the surface of the wetland as reddish, "rust", spots.

Isogram: A line joining areas with the same number of growing degree days (GDD).

Isolated Wetlands: Wetlands with no surface outflow, See Biological Component, Section 1.1.3.

Lacustrine Wetlands: Wetlands influenced by lake waters. See Biological Component, Section 1.1.3.

Lagg: The depressed zone, or moat that develops at the periphery of some wetlands which is generally wetter than the surrounding area and often contains open water.

Lake: Areas of open water that are greater than 8 ha in size and, at some location, are greater than 2 m in depth from the normal low water mark.

- Major Lake (in northern Ontario): Lake Superior, Lake Huron (including Georgian Bay)
- Great Lake (in northern Ontario): Lake Superior, Lake Huron (including Georgian Bay)

Littoral Zone: The shallow water zone in a lake, pond or river, where most of the aquatic plants (emergent, submergents and floating plants) exist, and within which most of the primary production occurs. The width and depth of the littoral zone depends on dissolved nutrients, soils, depth contours, water temperature, and water clarity (which affects light penetration). Marshes as a rule are entirely in the littoral zone.

Low Marsh: For the purpose of this evaluation, low marsh is defined as the marsh area from the existing water line out to the outer boundary of the wetland.

Marine Terraces: A narrow coastal strip covered by sand, silt, or fine gravel which slopes gently seaward.

Marl: A loose, crumbling deposit consisting of a mixture of clay, calcite, dolomite or invertebrate shells under still seawater, fresh water, or under a layer of peat or vegetation.

Marsh: See Biological Component, Section 1.1.2.

Mesic: Of or relating to organisms or communities that have a moderate amount of moisture.

Metapopulations: subpopulations of a species that exist in a number of relatively isolated populations that occasionally exchange individuals through migration and dispersal

Microrelief: Minor variations in elevation or topography at a localized level.

Mineral Soil: Soil composed mainly of mineral matter with less than 20% organic matter, normally having a surface organic layer of less than 60 cm thick for fibric organics and less than 40 cm thick for humic/mesic organics. See Biological Component, Section 1.1.1.

Minerotrophic: Referring to waters rich in dissolved minerals, and plant species and communities which grow well in these conditions.

Moss (m): Mosses and liverworts on the ground and on fallen logs.

Muck: A classification of organic soil used in the soil surveys of Ontario. Muck soils are formed in wetlands, shallow lakes, or pond bottoms, and are composed almost entirely of organic matter (the remains of plant tissues). The organic matter may be partially or very well decomposed. Muck is essentially the same as "peat". The soil map "muck" classifications generally do not differentiate between various depths of organic matter, the degree of decomposition, the parent plant material, or the depth of the layers.

Narrow-leaved Emergents (ne): Erect, rooted, graminoid monocots, including horsetails, which maybe temporarily or permanently flooded at the base but are exposed at the upper portion and typically are less than 1.5 metres in height.

NHIC: Natural Heritage Information Centre

Niche: The unique position occupied by a particular species, conceived both in terms of the actual physical area that it inhabits and the function that it performs within the community.

Nursery: Areas where recently emerged fish larvae and young juveniles spend the first part of their lives. These areas have enough small food items, adequate oxygen levels, and most importantly, shelter from predators. In wetlands, these are usually quiet, still areas with abundant emergent and/or submergent vegetation.

OBM: Ontario Base Map

Ombrotrophic: Referring to soil or vegetation whose nutritive substances are obtained largely from precipitation, as in a bog.

Open Water: Lake water that is free of emergent vegetation or artificial obstructions.

Open Water Marsh: See Biological Component, Section 1.1.3.

Organic Soil: Soil consisting mainly of organic matter, such as peat, or muck.

Palsa: A covering of vegetation on a rounded or conical knoll, often an earth hummock.

Palustrine Wetlands: Wetlands with no or intermittent inflow and either permanent or intermittent outflow. See Biological Component, Section 1.1.3.

Passerine: Of or relating to Passeriformes the largest order of birds, consisting of perching birds.

Peat: Partially decomposed plant material that accumulates under saturated conditions.

Peatland: A general term that includes all types of peat-covered lands.

Perched Wetland: A wetland that is elevated and separated from the main body of groundwater by an unsaturated zone.

Permanent Streams: A stream whose bed lies below the water table, so that the stream flows continuously throughout the year. See intermittent stream.

Positional (or geometric) error: the difference between the location of a well-defined point (x, y, z) in the reference data set to the point identified through the mapping process.

Precision: related to accuracy, but instead refers to the degree of **conformity** or **dispersion** among a set of observations. For example, if a dart was thrown 100 times but slightly missed the "bull's-eye" each time then the accuracy would be considered poor (i.e., the intended target was never hit). However, precision could be considered high because the missed darts would form a tight grouping (i.e., the degree of dispersion was low). It also important to note that precision is often used in the context of numerical precision, which is a measure of exactness or degree of detail (i.e., the number of significant digits). **Map scale** is a common way to express spatial precision.

Primary Production: The use by photosynthetic plants of the sun's energy to synthesize carbohydrates, and transform carbohydrates into molecules of fats and proteins; the production of biomass by photosynthetic plants.

Private Land: See definition in the Social Component Section 2.6.

Public Land: Land in some form of public ownership.

Raptor: A bird of prey such as an owl, hawk, falcon, osprey, eagle, or vulture.

Recharge, Groundwater: See Hydrological Component, Section 3.2.

Reference dataset: an appropriate source data of higher accuracy, such as field data or independent source imagery with finer resolution.

Regional Significance: Important on an Ecoregional scale. May refer to a species or a habitat feature.

Riparian: Pertains to species or a community that has a significant influence on a river or stream, or conversely, are influenced by the river or stream.

River: A natural watercourse flowing towards an ocean, a lake, or another river.

- Large river: a river large enough to be mapped as a polygon (not a line) on an NTS map. See Hydrological Component, Section 3.1.
- Major river: in Northern Ontario St. Mary's River

Riverine Wetlands: Wetlands influenced by the waters of a river or permanent stream. See Biological Component, Section 1.1.3.

Robust Emergents (re): Robust monocots from 1.5 to 3 metres in height which may be temporarily or permanently flooded at the base but are exposed at the upper portion.

Sand: A soil mineral particle between .006 and .02 cm in size that is coarser than silt and finer than gravel, having quartz as its most common component.

Secondary Production: The energy acquired by primary consumers by the consumption of plant material.

Sedges: Any plant belonging to the family Cyperaceae which includes Carex species, cotton-grass (*Eriophorum* sp.), spike-rush (*Eleocharis* sp.), bulrush and clubrush (*Scirpus* sp.), umbrella-sedge (*Cyperus* sp.) and beak-rush (*Rynchospora* sp.).

Seeps: Localized wet areas where underground water surfaces and runs off.

Semi-permanent Pools: Wet areas that disappear only under the driest conditions.

Shorebirds: Birds that are typically found near the edge of bodies of water during significant parts of their lifecycles. Shorebirds are commonly characterized by long bills, legs and toes and include the plovers, oystercatchers, avocets, stilts, turnstones, sandpipers, yellowlegs, snipes, godwits, curlews and phalaropes.

Shrub, Tall (ts): Woody vegetation 1 to 6 metres in height, includes stunted and sapling trees species.

Shrub, Low (ls): Woody vegetation less than 1 m in height, includes seedling tree species.

Shrub, Dead (ds): Dead woody vegetation less than 6 metres in height.

Silt: A very small rock or mineral particle smaller than a very fine grain of sand and larger than coarse clay. It usually is defined as having a diameter from .002 mm to .06 mm.

Site Type: See Biological Component, Section 1.1.3.

Soil Moisture Regime: refers to the presence or absence either of ground water or of water held at a tension of less than 1500 kPa in the soil or in specific horizons during periods of the year. From: http://www.itc.nl/~rossiter/research/nsm/nsm_SMR.html

Spawning: The act of sexual reproduction in fish which usually takes place in weed or gravel beds.

Special Concern: A species with characteristics that make it sensitive to human activities or natural events. Listed as Special Concern on the Species at Risk in Ontario List.

Staging Area: Any area where migratory birds congregate to eat and rest prior to continuing their journey.

Submergent Plants (su): Rooted hydrophytes with leaves entirely under the water surface.

Substrate: A substrate consists of any mineral, bedrock, coarse fragment, or organic materials, normally above or covered by standing water that is less than two meters in depth.

Thematic error: if the reference data set (e.g., field data) at some selected sample point (x,y) is not the same as the assigned class as the one being currently mapped and/or reviewed.

Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed. Listed as Threatened on the Species at Risk in Ontario List.

Tree (h, c): Woody vegetation greater than 6 metres in height.

Trees, dead (dh, dc): dead woody vegetation greater thaan 6m in height.

Tributary: a stream, river brook or other watercourse which flows into a main-stem (or parent) river.

Turbidity: A cloudy or hazy appearance in water caused by the suspension of fine solids or colloids.

Unvegetated (u): Unvegetated open water areas less than 2 metres deep completely surrounded by wetland vegetation.

Upland Plants: species that are found in uplands in Ontario.

Vegetation Community: an assemblage of plant populations living in a prescribed area.

Vegetation Form: The physical structure or shape of the plant, determined by such features as height, branching patter, and leaf shape.

Vernal Pools: landform depressions that temporarily fill with water following spring snowmelt, heavy rainfalls or as a result of a high water table (Ontario Vernal Pool Association). Vernal pools vary in their size, shape, depth, timing and duration of flooding, but lack a permanent surface connection to other surface waterbodies. Vernal pools, because of their periodic drying do not support breeding populations of fish. Vernal pools are also known as seasonal, ephemeral or woodland pools. Note that not all vernal pools are wetlands *Wetland* vernal pools exhibit wetland characteristics, i.e., seasonally flooded, or where the water table is close to the surface; and the presence of hydric soils, and hydrophytic or water tolerant plants.

Watercourse: any flowing body of water, including rivers, streams and brooks.

Waterfowl: Birds of the family Anatidae, which includes ducks, geese, and swans.

Watershed: an area drained by a river, brook or creek. For example, the Humber River is a watershed which drains into the Lake Ontario sub-basin of the Great Lakes basin. A sub-watershed is the area drained by a tributary of the river, brook or creek (e.g., the East Humber River within the Humber River watershed.

WEDSR: Wetland Evaluation Data & Scoring Record

Wetland: Lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants.

Wetland Indicator Species: species mostly confined to wetlands in Ontario. Listed in Appendix 10.

Wetland Plant Species: species that are found in wetlands in Ontario. Listed in Appendix 10.

Wetland Type: See Biological Component, Section 1.1.2.

Wetland Unit: A single wetland or a contiguous group of wetland communities. The wetland unit is entirely surrounded by non-wetland areas.

WETLAND EVALUATION DATA AND SCORING RECORD

Wetland Name: _____

Geographic Location (municipality, lot/concession, etc):

_____

Map / Photo Locational Reference (e.g., latitude/longitude, NTS map, UTM):

_____

Eco-District: _____

Wetland Size (hectares): _____

Vegetation Form	FA
h	
c	
dh	
dc	
ts	
ls	
ds	
gc	
m	
ne	
be	
re	
ff	
f	
su	
u	

1.0 BIOLOGICAL COMPONENT

1.1 PRODUCTIVITY

1.1.1 Growing Degree-Days/Soils *(max: 30 pts)*

Refer to page 37 of manual for further explanation.

1. Determine the correct GDD value for your wetland (use Figure 5).
2. Circle the appropriate GDD value from the evaluation table below.
3. Determine the Fractional Area (FA) of the wetland for each soil type.
4. Multiply the fractional area of each soil type by the applicable score-factor in the evaluation table.
5. Sum the scores for each soil type to obtain the final score (maximum score is 30 points).

Growing Degree-Days	Clay-Loam	Silt-Marl	Lime-stone	Sand	Humic-Mesic	Fibric	Granite
<1600	12	11	9	7	7	6	4
1600-2000	15	13	11	9	8	7	5
2000-2400	18	15	13	11	9	8	7
2400-2800	22	18	15	13	11	9	7
2800-3000	26	21	18	15	13	10	8
>3000	30	25	20	18	15	12	9

Soil Type	FA of wetland in soil type	Enter appropriate score-factor from above table	
Clay/Loam		X	=
Silt/Marl:		X	=
Limestone:		X	=
Sand:		X	=
Humic/Mesic:		X	=
Fibric:		X	=
Granite:		X	=
Total			

GDD/Soils Score *(maximum 30 points)* _____

1.1.2 Wetland Type

(Fractional Areas = area of wetland type/total wetland area)

	Fractional Area		Score
Bog		x 3 =	
Fen		x 6 =	
Swamp		x 8 =	
Marsh		x 15 =	
Total		=	

Wetland Type Score *(maximum 15 points)* _____

1.1.3 Site Type

(Fractional Area = area of site type/total wetland area)

	Fractional Area		Score
Isolated		x 1 =	
Palustrine (permanent or intermittent flow)		x 2 =	
Riverine		x 4 =	
Riverine (at rivermouth)		x 5 =	
Lacustrine (at rivermouth)		x 5 =	
Lacustrine (with barrier beach)		x 3 =	
Lacustrine (exposed to lake)		x 2 =	
Total		=	

Site Type Score *(maximum 5 points)* _____

1.2 BIODIVERSITY

1.2.1 Number of Wetland Types

(Check only one)

	One	=	9 points
	Two	=	13
	Three	=	20
	Four	=	30

Number of Wetland Types Score
(maximum 30 points) _____

1.2.2. Vegetation Communities

Use the data sheet provided in Appendix 4 to record and score vegetation communities (the completed form must be attached to this data record)

Scoring *(circle only one option for each of the columns below):*

Total # of communities with **1-3 forms**	
1 =	1.5 pts
2 =	2.5
3 =	3.5
4 =	4.5
5 =	5
6 =	5.5
7 =	6
8 =	6.5
9 =	7
10 =	7.5
11 =	8
+ 0.5 *for each additional community* =	

Total # of communities with **4-5 forms**	
1 =	2 pts
2 =	3.5
3 =	5
4 =	6.5
5 =	7.5
6 =	8.5
7 =	9.5
8 =	10.5
9 =	11.5
10 =	12.5
11 =	13
+ 0.5 *for each additional community* =	

Total # of communities with **6 or more forms**	
1 =	3 pts
2 =	5
3 =	7
4 =	9
5 =	10.5
6 =	12
7 =	13.5
8 =	15
9 =	16.5
10 =	18
11 =	19
+ 1.0 *for each additional community* =	

Vegetation Communities Score
(maximum 45 points) _____

1.2.3 Diversity of Surrounding Habitat

Check all appropriate items. Only habitat within 1.5 km of the wetland boundary and at least 0.5 ha in size are to be scored.

	recent burn (<5 yr)
	abandoned agricultural land
	utility corridor
	deciduous forest
	recent cutover or clearcut (<5 yr)
	coniferous forest
	mixed forest*
	crops
	abandoned pits and quarries
	pasture
	ravine
	fencerows
	open lake or deep river
	creek floodplain
	rock outcrop

* *"Mixed forest" is defined as either 25% coniferous trees distributed singly or in clumps in deciduous forest, or 25% deciduous trees distributed singly or in clumps in coniferous forest. Note that Forest Resource Inventory (FRI) maps can be misleading since 25% conifer within a unit could be entirely concentrated around a lake.*

Score 1 point for each feature checked, up to a maximum of 7 points.

Diversity of Surrounding Habitat Score
(maximum 7 points) _____

1.2.4 Proximity to Other Wetlands

Check highest appropriate category. (Note: if the wetland is lacustrine, score option #1 at 8 points).

✓		Points
	Hydrologically connected by surface water to other wetlands (different dominant wetland type), or to open lake or river within 1.5 km	8
	Hydrologically connected by surface water to other wetlands (same dominant wetland type) within 0.5 km	8
	Hydrologically connected by surface water to other wetlands (different dominant wetland type), or to open lake or river from 1.5 to 4 km away	5
	Hydrologically connected by surface water to other wetlands (same dominant wetland type) from 0.5 to 1.5 km away	5
	Within 0.75 km of other wetlands (different dominant wetland type) or open lake or river, but not hydrologically connected by surface water	5
	Within 1 km of other wetlands, but not hydrologically connected by surface water	2
	No wetland within 1 km	0

Name and distance (from wetland) of wetlands/waterbodies scored above:

_____

_____

Proximity to other Wetlands Score
(maximum 8 points) _____

1.2.5 Interspersion

Number of Intersections = _____

✓	Number of Intersections *(Check one only)*	Points
	26 or less	= 3
	27 to 40	= 6
	41 to 60	= 9
	61 to 80	= 12
	81 to 100	= 15
	101 to 125	= 18
	126 to 150	= 21
	151 to 175	= 24
	176 to 200	= 27
	>200	= 30

Interspersion Score *(maximum 30 points)* _____

1.2.6 Open Water Types

NOTE: *this attribute is only to be scored for permanently flooded open water within the wetland (adjacent lakes do not count). Check one option only.*

	Open Water Type	Characteristic	Points
	Type 1	Open water occupies < 5 % of wetland area	= 8
	Type 2	Open water occupies 5-25% of wetland (occurring in central area)	= 8
	Type 3	Open water occupies 5-25% (occurring in various-sized ponds, dense patches of vegetation or vegetation in diffuse stands)	= 14
	Type 4	Open water occupies 26-75% of wetland (occurring in a central area)	= 20
	Type 5	Open water occupies 26-75% of wetlands (small ponds and embayments are common)	= 30
	Type 6	Open water occupies 76%-95% of wetland (occurring in large central area; vegetation is peripheral)	= 8
	Type 7	Open water occupies 76-95% of wetland (vegetation in patches or diffuse open stands)	= 14
	Type 8	Open water occupies more than 95% of wetland area	= 3
	No open water		= 0

Open Water Type Score *(maximum 30 points)* _____

1.3 SIZE

(BIOLOGICAL COMPONENT)

Total Size of Wetland = _____ ha

Sum of scores from Biodiversity Subcomponent

1.2.1
+ 1.2.2
+ 1.2.3
+ 1.2.4
+ 1.2.5
+ 1.2.6

Circle the appropriate score from the table below.

Wetland size (ha)	Total Score for Biodiversity Subcomponent									
	<37	37-47	48-60	61-72	73-84	85-96	97-108	109-120	121-132	>132
<20 ha	1	5	7	8	9	17	25	34	43	50
20-40	5	7	8	9	10	19	28	37	46	50
41-60	6	8	9	10	11	21	31	40	49	50
61-80	7	9	10	11	13	23	34	43	50	50
81-100	8	10	11	13	15	25	37	46	50	50
101-120	9	11	13	15	18	28	40	49	50	50
121-140	10	13	15	17	21	31	43	50	50	50
141-160	11	15	17	19	23	34	46	50	50	50
161-180	13	17	19	21	25	37	49	50	50	50
181-200	15	19	21	23	28	40	50	50	50	50
201-400	17	21	23	25	31	43	50	50	50	50
401-600	19	23	25	28	34	46	50	50	50	50
601-800	21	25	28	31	37	49	50	50	50	50
801-1000	23	28	31	34	40	50	50	50	50	50
1001-1200	25	31	34	37	43	50	50	50	50	50
1201-1400	28	34	37	40	46	50	50	50	50	50
1401-1600	31	37	40	43	49	50	50	50	50	50
1601-1800	34	40	43	46	50	50	50	50	50	50
1801-2000	37	43	47	49	50	50	50	50	50	50
>2000	40	46	50	50	50	50	50	50	50	50

Size Score (Biological Component)
(maximum 50 points) _____

2.0 SOCIAL COMPONENT

2.1 ECONOMICALLY VALUABLE PRODUCTS

2.1.1 Wood Products

Check the option that best reflects the total area (ha) of forested wetland (i.e., areas where the dominant vegetation form is h or c). Note that this is the area of all the forested vegetation communities, not total wetland size. Do not include area where harvest is not permitted. Check only one option.

Area of wetland used for scoring 2.1.1: _____

	< 5 ha	=	0 pts
	5 - 25 ha	=	4
	26 – 50 ha	=	6
	51 – 100 ha	=	8
	101 – 200 ha	=	11
	> 200 ha	=	14

Source of information:

_____

_____

Wood Products Score *(maximum 14 points)* _____

2.1.2 Lowbush Cranberry

Check only one.

	Present	=	2 pts
	Absent	=	0
	Harvest not permitted	=	0

Source of information:

_____

_____

Lowbush Cranberry Score *(maximum 2 points)* _____

2.1.3 Wild Rice

Check only one.

	Present (min. size 0.5 ha)	=	10 pts
	Absent	=	0
	Harvest not permitted	=	0

Source of information:

_____

_____

Wild Rice Score *(maximum 10 points)* _____

2.1.4 Commercial Baitfish

Check only one.

	Present	=	12 pts
	Absent	=	0
	Fishing not permitted	=	0

Source of information:

_____

_____

Commercial Baitfish Score *(maximum 12 points)* _____

2.1.5 Furbearers

Only species recognized as furbearers under the Fish & Wildlife Conservation Act may be scored. Score 3 points for each furbearer species listed, up to a maximum of 12 points. Score 0 points if trapping is prohibited.

	Name of furbearer	Source of information
1.		
2.		
3.		
4.		
5.		
6.		

Furbearer Score *(maximum 12 points)* _____

2.2 RECREATIONAL ACTIVITIES

Sources of information and reasons for scoring a wetland under high or moderate use below, must be included below.

Circle one score for each of the activities listed. Score is cumulative – add score for hunting, nature enjoyment and fishing together for final score.

Intensity of Use	Type of Wetland-Associated Use		
	Hunting	Nature Enjoyment/ Ecosystem Study	Fishing
High	40 points	40 points	40 points
Moderate	20	20	20
Low	8	8	8
Not Possible/ No evidence	0	0	0

Sources of information (include evidence/criteria forming basis for score and any relevant reference used to obtain that information):

Hunting: _____

Nature: _____

Fishing: _____

Recreational Activities Score
(maximum 80 points) _____

2.3 LANDSCAPE AESTHETICS

2.3.1 Distinctness

Check only one.

	Clearly Distinct	=	3 pts
	Indistinct	=	0

Landscape Distinctness Score
(maximum 3 points) _____

2.3.2 Absence of Human Disturbance

Check only one.

	Human disturbances absent or nearly so	=	7 pts
	One or several localized disturbances	=	4
	Moderate disturbance; localized water pollution	=	2
	Wetland intact but impairment of ecosystem quality intense in some areas	=	1
	Extreme ecological degradation, or water pollution severe and widespread	=	0

Details regarding type, extent and location of disturbance scored:

_____

_____

_____

Source of information:

_____

_____

Absence of Human Disturbance Score
(maximum 7 points) _____

2.4 EDUCATION AND PUBLIC AWARENESS

2.4.1 Educational Uses

Check highest appropriate category.

	Frequent	=	20 pts
	Infrequent	=	12
	No visits	=	0

Details regarding the type and frequency of education uses scored above:

_____

_____

_____

Source of information:

_____

_____

Educational Uses Score *(maximum 20 points)* _____

2.4.2 Facilities and Programs

Check all appropriate options, score highest category checked.

	Staffed interpretation centre with shelters, trails, literature	=	8 pts
	No interpretation centre or staff, but a system of self-guiding trails and observation points or brochures available	=	4
	Facilities such as maintained paths (e.g., woodchips), boardwalks, boat launches or observation towers, but no brochures or other interpretation	=	2
	No facilities or programs	=	0

Additional Notes/Comments:

_____

_____

_____

Source of information:

_____

_____

Facilities and Programs Score
(maximum 8 points) _____

2.4.3 Research and Studies

Check all that apply; score highest category checked.

	Long term research has been done	=	12 pts
	Research papers published in refereed scientific journal or as a thesis	=	10
	One or more (non-research) reports have been written on some aspect of the wetland's flora, fauna, hydrology, etc.	=	5
	No research or reports	=	0

List of reports, publications, research studies etc scored above:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Research and Studies Score
(maximum 12 points) _____

2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT

Name of Settlement: _____

Distance of wetland from settlement: _____

Population of settlement: _____ (Source: _____)

Circle only the highest score applicable

Distance of wetland to settlement	population >10,000	population 2,500-10,000	population <2,500 or cottage community
within or adjoining settlement	40 points	26 points	16 points
0.5 to 10 km from settlement	26	16	10
10 to 60 km from settlement	12	8	4
60-100 km from nearest settlement	5	2	0
>100 km from nearest settlement	0	0	0

Proximity to Human Settlement Score
(maximum 40 points) _____

2.6 OWNERSHIP

FA of wetland on land held by or held under a legal contract by a conservation body (as defined by the *Conservation Land Act*) for wetland protection	_____ x 10 = _____
FA of wetland occurring in provincially or nationally protected areas (e.g., parks and conservation reserves)	_____ x 10 = _____
FA of wetland area in Crown/public ownership, not as above	_____ x 8 = _____
FA of wetland area in private ownership, not as above	_____ x 4 = _____

Source of information:

_____

_____

Ownership Score *(maximum 10 points)* _____

2.7 SIZE (SOCIAL COMPONENT)

Total Size of Wetland = _____ ha Sum of scores from Subcomponents 2.1, 2.2, and 2.5 = _____

Circle the appropriate score from the table below.

	Total for Size Dependent Social Features									
	<31	31-45	46-60	61-75	76-90	91-105	106-120	121-135	136-150	>150
<5	1	2	4	8	12	13	14	14	15	16
5-8	2	2	5	9	13	14	15	15	16	16
9-12	3	3	6	10	14	15	15	16	17	17
13-17	3	4	7	10	14	15	16	16	17	17
18-28	4	5	8	11	15	16	16	17	17	18
29-37	5	7	10	13	16	17	18	18	19	19
38-49	5	7	10	13	16	17	18	18	19	20
50-62	5	8	11	14	17	17	18	19	20	20
63-81	5	8	11	15	17	18	19	20	20	20
82-105	6	9	11	15	18	18	19	20	20	20
106-137	6	9	12	16	18	19	20	20	20	20
138-178	6	9	13	16	18	19	20	20	20	20
179-233	6	9	13	16	18	20	20	20	20	20
234-302	7	9	13	16	18	20	20	20	20	20
303-393	7	9	14	17	18	20	20	20	20	20
394-511	7	10	14	17	18	20	20	20	20	20
512-665	7	10	14	17	18	20	20	20	20	20
666-863	7	10	14	17	19	20	20	20	20	20
864-1123	8	12	15	17	19	20	20	20	20	20
1124-1460	8	12	15	17	19	20	20	20	20	20
1461-1898	8	13	15	18	19	20	20	20	20	20
1899-2467	8	14	16	18	20	20	20	20	20	20
>2467	8	14	16	18	20	20	20	20	20	20

Total Size Score (Social Component) _____

2.8 ABORIGINAL VALUES AND CULTURAL HERITAGE

Either or both Aboriginal or Cultural Values may be scored. However, the maximum score permitted for 2.8 is 30 points.

Full documentation of sources must be attached to the data record.

2.8.1 Aboriginal Values

	Significant	=	30 pts
	Not Significant	=	0
	Unknown	=	0

Additional Comments/Notes:

2.8.2 Cultural Heritage

	Significant	=	30 pts
	Not Significant	=	0
	Unknown	=	0

Additional Comments/Notes:

Aboriginal Values/Cultural Heritage Score
(maximum 30 points) _____

3.0 HYDROLOGICAL COMPONENT

3.1 FLOOD ATTENUATION

Check one of the following options.

_____ If wetland is a *coastal wetland*, ➡ score 0 points for this section.

_____ If the wetland is entirely lacustrine and the ratio of wetland area to lake area is less than 0.1, ➡ score 0 points for this section.

_____ If wetland is entirely isolated in site type, ➡ score 100 points automatically.

Wetland not as above – proceed through steps A through G below.

(A) Total wetland area = _____ha
(B) Size of wetland's catchment = _____ha
(C) Size of other detention areas in catchement = _____ha

Wetland Surface Form (select the form which best describes the non-coastal units of the wetland):
___ flooded with little or no aquatic vegetation = 0
___ flooded but with submergent, emergent, or floating vegetation = 0.2
___ flat (lawn) vegetation (typical of fens) = 0.5
___ hummock-depression microtopography = 0.7
___ patterned (e.g. string bog, ribbed fen) = 1.0

(D) Wetland Surface Form Factor = _____ (maximum 1.0)
(E) Total area of upstream detention areas* = {A + C} = _____ ha
(F) Upstream Detention Factor = {(A/E) x 2} = _____ (maximum 1.0)
(G) Attenuation Factor = {(A/B) x 10} = _____ (maximum 1.0)

Flood Attenuation Final Score = ([F + G + D] /3) x 100] = _____

Flood Attenuation Score *(maximum 100 points)* _____

3.2 GROUNDWATER RECHARGE

3.2.1 Site Type

Wetland > 50% lacustrine (by area) or located on the St. Mary's River		= 0 pts	
Wetland not as above. Calculate final score as follows:			
■ FA of isolated or palustrine wetland	=	x 20 =	
■ FA of riverine wetland	=	x 5 =	
■ FA of lacustrine wetland (when wetland is <50% lacustrine)"	=	x 0 =	

Groundwater Recharge/Wetland Site Type Score *(maximum 20 points)* _____

3.2.2 Soil Recharge Potential

*Circle only one choice that **best** describes the soils in* **the area surrounding the wetland** *being evaluated (the soils within the wetland are not scored here).*

Dominant Wetland Type	Group A, B, C (sands, gravels, loams)	Group D (clays, substrates in high water tables, shallow substrates over impervious materials such as bedrock)
Lacustrine or on St. Mary's River	0	0
Isolated	10	5
Palustrine	7	4
Riverine (not on a major river)	5	2

Groundwater Recharge/Wetland Soil Recharge Potential Score *(maximum 10 points)* _____

3.3 DOWNSTREAM WATER QUALITY IMPROVEMENT

3.3.1 Watershed Improvement Factor

Calculation of Watershed Improvement Score is based upon the fractional area (FA) of each site type within the wetland.
FA = area of site type/total area of the wetland

			Improvement Factor
FA of isolated wetland	=	x 0.5 =	
FA of riverine wetland	=	x 1.0 =	
FA of palustrine wetland with no inflow	=	x 0.7 =	
FA of palustrine wetland with inflows	=	x 1.0 =	
FA of lacustrine on lake shoreline	=	x 0.2 =	
FA of lacustrine at lake inflow or outflow	=	x 1.0 =	

Watershed Improvement Score (IF x 30)
(maximum = 30) _____

3.3.2 Adjacent and Watershed Land Use

EVALUATION:

Step 1. Determination of Maximum Initial Score

☐ Wetland on the Great Lakes or St. Mary's River (Go to Step 5a)
☐ All other wetlands (Go through steps 2, 3, 4, and 5b)

Step 2. Determination of Broad Upslope Land Use (BLU)

Assess broad upslope land uses as logging within the previous 5 years, agriculture, or other activities which alter the natural vegetation cover in an extensive manner.

Choose one	Score
☐ > 50% of catchment basin	20
☐ 20-50% of catchment basin	14
☐ < 20% of catchment basin	4

Score for BLU _____

Step 3. Determination of Linear Upslope Land Uses (LUU)

Assess linear upslope uses (LUU) e.g., roads, railways, hydro corridors, pipelines, etc., crossing the upslope catchment within 200 m of the wetland boundary.

	Choose the highest only	Score
	Major corridor[1]	15
	Secondary corridor	11
	Tertiary corridor	6
	Temporary or abandoned	3
	None	0

Score for LUU _____

Step 4. Determination of Point-source Land Uses (PS)

Assess pont source (PS) land uses producing industrial effluents such as heavy industry, pulp and paper plants, major aggregate operations (but not small pits use for local road construction), etc. Score as 'present' only if a point source land use is located less than 1 km upstream from the wetland.

		Score
	Present	15
	Not present	0

Score for PS _____

Step 5. Calculation of total score for Adjacent and Watershed Land Use

		Score
	a) Wetland on the Great Lakes or St. Mary's River	0
	b) All other wetlands, calculate as follows:	

Final Score BLU + LUU + PS _____

3.3.3 Vegetation Form

Choose the category that best describes the vegetation of the wetland.

		Score
	Trees, shrubs or herbs (h, c, ts, ls, gc)	8 points
	Emergents, submergents (ne, re, be, f, ff, su)	10
	Little or no vegetation (u)	0

Dominant Vegetation Form Score
(maximum 10 points) _____

1. Major, secondary and tertiary roads are those that are indicated as such on the provincial highways map. Major hydro corridors are trunk lines coming directly from a generating station. Major pipelines are trans-continental lines. Secondary corridors are regional distribution lines (i.e. multi-cable hydro corridors not emanating directly from a generating station or regional gas distribution lines). Tertiary corridors are single hydro lines or local gas distribution lines (i.e. to domestic users).

3.4 CARBON SINK

Check only one of the following

	Bog or fen with more than 50% coverage by organic soil	=	15 pts
	Wetland with between 10 to 50% coverage by organic soil (i.e., mainly mineral or undesignated soils, any wetland type)	=	6
	Marshes and swamps with more than 50% coverage organic soil	=	9
	Wetland with less than 10% soils organic	=	0

Source of information:

_____

_____

Carbon Sink Score *(maximum 15 points)* _____

3.5 SHORELINE EROSION CONTROL

From the wetland vegetation map determine the **dominant** vegetation type within the erosion zone for **lacustrine and riverine site type areas only**. Score according to the factors listed below.

Step 1:

	Wetland entirely isolated or palustrine	=	0 pts
	Any part of the wetland is riverine or lacustrine	=	Go to step 2

Step 2: *Choose the one characteristic that best describes the shoreline vegetation (see page 112 for description of "shoreline".)*

	Trees and shrubs	=	15 pts
	Emergent vegetation	=	8
	Submergent vegetation	=	6
	Other shoreline vegetation	=	3
	No vegetation	=	0

Shoreline Erosion Control Score
(maximum 15 points) _____

3.6 GROUNDWATER DISCHARGE

Circle the characteristics that best describe the wetland being evaluated and then sum the scores. If the sum exceeds 30 points, assign the maximum score of 30). NOTE: *for wetland type, wetland type scored does not have to the dominant type in the wetland.*

		Catchment Interaction/Potential for Discharge		
		None to Little	Some	High
Wetland Characteristics	Wetland type Presence/absence	Bog = 0	Swamp/Marsh = 2	Fen = 5
	Basin Topography	Flat/rolling = 0	Hilly = 2	Major Relief Break = 5
	Wetland area: Upslope catchment area	Large (>50%) = 0	Moderate (5-50%) = 2	Small (<5%) = 5
	Lagg development	None found = 0	Minor = 2	Extensive = 5
	Seeps	None = 0	≤ 3 seeps = 2	> 3 seeps = 5
	Iron precipitates	None = 0	≤ 3 sites = 2	> 3 sites = 5
	Surface marl deposits	None = 0	≤ 3 sites = 2	> 3 sites = 5
	Wetland pH	Low < 4.2 = 0	Moderate 4.2-5.7 = 5	High >5.7 = 10
	Catchment soil coverage	Patchy = 0	Thin (<20 cm) = 2	Thick = 5
	Catchment soil permeability	Low = 0	Moderate = 2	High = 5

Additional Comments/Notes:

Groundwater Discharge Score
(maximum 30 points) _____

4.0 SPECIAL FEATURES COMPONENT

4.1 RARITY

4.1.1 Wetlands

Wetland type *(check one or more)*

- [ ] Bog
- [ ] Fen
- [ ] Swamp
- [ ] Marsh

Ecoregion/Ecodistrict		Marsh	Swamp	Fen	Bog
2E	James Bay	20	20	0	20
2W	Big Trout Lake	20	20	0	10
3E	Lake Abitibi	20	20	10	0
3W	Lake Nipigon	20	20	10	0
3S	Lake St. Joseph	20	20	10	0
4E	Lake Temagami	20	20	10	0
4W	Pigeon River	20	10	20	0
4S	Wabigoon Lake	20	10	20	0
5E-1	Thessalon	10	0	30	20
5E-3	La Cloche	20	0	30	20
5E-4	Sudbury	10	0	30	10
5E-5	North Bay	10	0	20	0
5E-6	Tomiko	10	0	20	0
5E-7	Parry Sound	20	0	30	20
5E-8	Huntsville	20	0	30	20
5E-9	Algonquin Park	10	0	30	0
5E-10	Brent	20	0	30	0
5E-11	Bancroft	0	10	30	10
5E-13	Western Sault Ste. Marie – Lake Superior Coast	20	0	10	30
5-S	Lake of the Woods	10	10	20	10

Rarity of Wetland Type Score
(maximum 70 points) _____

4.1.2.1 Provincially Significant Animal Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

Additional Notes/Comments:

One species	=	50 pts	9 species	=	140 pts	17 species	=	160 pts
2 species	=	80	10 species	=	143	18 species	=	162
3 species	=	95	11 species	=	146	19 species	=	164
4 species	=	105	12 species	=	149	20 species	=	166
5 species	=	115	13 species	=	152	21 species	=	168
6 species	=	125	14 species	=	154	22 species	=	170
7 species	=	130	15 species	=	156	23 species	=	172
8 species	=	135	16 species	=	158	24 species	=	174
						25 species	=	176

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

Provincially Significant Animal Species
(no maximum) _____

4.1.2.2 Provincially Significant Plant Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

Additional Notes/Comments:

One species	=	50 pts	9 species	=	140 pts	17 species	=	160 pts
2 species	=	80	10 species	=	143	18 species	=	162
3 species	=	95	11 species	=	146	19 species	=	164
4 species	=	105	12 species	=	149	20 species	=	166
5 species	=	115	13 species	=	152	21 species	=	168
6 species	=	125	14 species	=	154	22 species	=	170
7 species	=	130	15 species	=	156	23 species	=	172
8 species	=	135	16 species	=	158	24 species	=	174
						25 species	=	176

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

Provincially Significant Plant Species
(no maximum) _____

4.1.2.3 Regionally Significant Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

*** Score only if there is an approved list.*

Scoring:

One species= 20 pts	4 species = 45 pts	7 species = 58 pts
2 species = 30	5 species = 50	8 species = 61
3 species = 40	6 species = 55	9 species = 64
		10 species = 67

For each significant species over 10 in wetland, add 1 point.

Regionally Significant Species Score
(no maximum score) _____

4.1.2.4 Locally Significant Species (Ecodistrict)

Common Name	Scientific Name	Activity	Dates Observed	Info Source

Scoring:

One species= 10 pts	4 species = 31 pts	7 species = 43 pts
2 species = 17	5 species = 38	8 species = 45
3 species = 24	6 species = 41	9 species = 47
		10 species = 49

For each significant species over 10 in wetland, add 1 point.

Locally Significant Species Score
(no maximum score) _____

4.1.2.5 Species of Special Status

Black Duck

Suitable breeding habitat present and within assessment range (Figure 22)

Assessment Category	Check one	Points
20 - 40 Indicated Pairs/100 km sq		= 20
10 - 20 Indicated Pairs/100 km sq		= 15
5 - 10 Indicated Pairs/100 km sq		= 10
1 - 5 Indicated Pairs/100 km sq		= 5
Habitat not suitable		= 0
Out of assessment range		= 0

Additional Notes/Comments:

Black Duck Score
(maximum 20 points) _____

4.2 SIGNIFICANT FEATURES AND HABITATS

4.2.1 Colonial Waterbirds

Record all available information. Score the highest applicable category. Include additional information as possible (e.g., nest locations, etc).

Activity	Species	Info Source	Points
Currently nesting			= 50
Known to have nested within the past 5 years			= 25
Active feeding area (great blue heron excluded)			= 15
None known			= 0

Additional Notes/Comments:

Colonial Waterbird Nesting Score
(maximum 50 points) _____

4.2.2 Winter Cover for Wildlife

Score highest appropriate category. Include rationale/sources of information.

	Provincially significant	=	100 pts
	Significant in Ecoregion	=	50
	Significant in Ecodistrict	=	25
	Locally significant	=	10
	Little or poor winter cover	=	0

Species/habitat/vegetation community scored *(e.g., winter deer cover in hemlock swamp, S3 and S4b)*:

Source of information:

Winter Cover for Wildlife Score
(maximum 100 points) _____

4.2.3 Waterfowl Staging and/or Moulting Areas

Check highest level of significance for both staging and moulting; add scores for staging and for moulting together for final score. However, maximum score for evaluation under this section is 150 points.

	Staging	Moulting
Nationally/internationally significant	= 150 pts	= 150 pts
Provincially significant	= 100	= 100
Significant in the Ecoregion	= 50	= 50
Significant in the Ecodistrict	= 25	= 25
Locally Signifcant/ Known to occur	= 10	= 10
Not possible/Unknown	= 0	= 0

Species/habitat/vegetation community scored *(e.g., approx 20 mallards in W3)*:

Source of information:

Waterfowl Staging/Moulting Score
(maximum 150 points) _____

4.2.4 Waterfowl Breeding

Check highest level of significance.

	Nationally/internationally significant	=	150 pts
	Provincially significant	=	100
	Significant in Ecoregion	=	50
	Signficant in Ecodistrict	=	25
	Locally significant/Known to occur	=	10
	Habitat not suitable	=	0

Species/habitat/vegetation community scored *(e.g., mallard in W3)*:

Source of information:

Waterfowl Breeding Score
(maximum 150 points) _____

4.2.5 Migratory Passerine, Shorebird or Raptor Stopover Area

Check highest level of significance.

	Nationally/Internationally significant	=	150 pts
	Provincially significant	=	100
	Significant in Ecoregion	=	50
	Significant in Ecodistrict	=	25
	Locally significant/Known to occur	=	10
	Not possible/Unknown	=	0

Species/habitat/vegetation community scored:

Source of information:

Passerine, Shorebird or Raptor Stopover Score
(maximum 150 points) _____

4.2.6 Ungulate habitat

EVALUATION:

Score (1) + (2) + one of (3) to (6)

		Score
	1. Ungulate summer cover	= 15 points
	2. Mineral licks	= 50
	3. Moose aquatic feeding area Class 1	= 0
	4. Moose aquatic feeding area Class 2	= 10
	5. Moose aquatic feeding area Class 3	= 20
	6. Moose aquatic feeding area Class 4	= 35

(Score is cumulative for a maximum possible score of 100)

Ungulate Habitat Score
(maximum 100 points) _____

4.2.7 Fish Habitat

4.2.7.1 Spawning and Nursery Habitat

Area Factors for Low Marsh, High Marsh and Swamp Communities.

No. of ha of Fish Habitat	Area Factor
< 0.5 ha	0.1
0.5 – 4.9	0.2
5.0 – 9.9	0.4
10.0 – 14.9	0.6
15.0 – 19.9	0.8
20.0 +	1.0

Step 1:

☐ Fish habitat is not present within the wetland	Go to Step 7, Score 0 points
☐ Fish habitat is present within the wetland	Go to Step 2

Step 2: *Choose only one option*

☐ Significance of the spawning and nursery habitat within the wetland is known	Go to Step 3
☐ Significance of the spawning and nursery habitat within the wetland is not known	Go through Steps 4, 5 and 6

Step 3: *Select the highest appropriate category below, attach documentation:*

☐ Significant in Ecoregion	Go to Step 7, Score 100 points
☐ Significant in Ecodistrict	Go to Step 7, Score 50 points
☐ Locally Significant Habitat (5.0+ ha)	Go to Step 7, Score 25 points
☐ Locally Significant Habitat (<5.0 ha)	Go to Step 7, Score 15 points

Step 4: Low Marsh = the '*permanent*' marsh area, from the existing water line out to the outer boundary of the wetland.

☐ Low marsh not present	Go to Step 5
☐ Low marsh present	Continue through Step 4, scoring as noted below

Scoring of Low Marsh:

1. Check the appropriate **Vegetation Group** (see Appendix 7) for each Low Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each Low Marsh vegetation community.)
2. Sum the areas (ha) of the vegetation communities assigned to each **Vegetation Group**.
3. Use these areas to assign an Area Factor (from Table 7) for each checked **Vegetation Group**.
4. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate **Score**.
5. Sum all numbers in Score column to get **Total Score for Low Marsh**.

Scoring for Presence of Key Vegetation Groups – Low Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
1	Tallgrass				6	
2	Shortgrass-Sedge				11	
3	Cattail-Bulrush-Burreed				5	
4	Arrowhead-Pickerelweed				5	
5	Duckweed				2	
6	Smartweed-Waterwillow				6	
7	Waterlily-Lotus				11	
8	Waterweed-Watercress				9	
9	Ribbongrass				10	
10	Coontail-Naiad-Watermilfoil				13	
11	Narrowleaf Pondweed				5	
12	Broadleaf Pondweed				8	
	Total Score for Low Marsh (maximum 75 points)					

Continue to Step 5

Step 5: High Marsh = the 'seasonal' marsh area, from the water line to the inland boundary of marsh wetland type. This is essentially what is commonly referred to as a wet meadow, in that there is insufficient standing water to provide fisheries habitat except during flood or high water conditions.

☐	High marsh not present	Go to Step 6
☐	High marsh present	Continue through Step 5, scoring as noted below

Scoring of High Marsh:

1. Check the appropriate **Vegetation Group** (see Appendix 7) for each High Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each High Marsh vegetation community.)
2. Sum the areas (ha) of the vegetation communities assigned to each **Vegetation Group**.
3. Use these areas to assign an **Area Factor** (from Table 7) for each checked **Vegetation Group**.
4. Multiply the Area Factor by the **Multiplication Factor** for each row to calculate **Score**.
5. Sum all numbers in Score column to get **Total Score for High Marsh**.

Scoring for Presence of Key Vegetation Groups – High Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
1	Tallgrass				6	
2	Shortgrass-Sedge				11	
3	Cattail-Bulrush-Burreed				5	
4	Arrowhead-Pickerelweed				5	
	Total Score for High Marsh (maximum 25 points)					

Continue to Step 6

Step 6:

Swamp: Swamp communities containing fish habitat, either seasonally or permanently. Determine the total area of seasonally flooded swamps and permanently flooded swamps containing fish habitat.

☐	Swamp containing fish habitat not present	Go to Step 7
☐	Swamp containing fish habitat present	Continue through Step 6, scoring as follows

Scoring of Swamp:

1. Determine the total area (ha) of seasonally flooded swamp communities within the wetland containing fish habitat and record below.
2. Determine the total area (ha) of permanently flooded swamp communities within the wetland containing fish habitat and record in below.
3. Use these areas to assign an **Area Factor** (from Table 7).
4. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate Score.
5. Sum all numbers in Score column to get **Total Score for Swamp.**

Scoring Swamps for Fish Habitat (Seasonally Flooded; Permanently Flooded)

Swamp Containing Fish Habitat	Present (check)	Total Area (ha)	Area Factor (from Table 7)	Multiplication Factor	Score
Seasonally Flooded Swamp				10	
Permanently Flooded Swamp				10	
			Total Score for Swamp (maximum 20 points)		

Continue to Step 7

Step 7: CALCULATION OF FINAL SCORE

NOTE: Scores for Steps 4, 5 and 6 are only recorded if Steps 1 and 3 have not been scored.

A. Score from Step 1 (fish habitat not present) = _____
B. Score from Step 3 (significance known) = _____
C. Score from Step 4 (Low Marsh) = _____
D. Score from Step 5 (High Marsh) = _____
E. Score from Step 6 (Swamp) = _____

Calculation of Final Score for Spawning and Nursery Habitat = A or B or Sum of C, D, and E

Score for Spawning and Nursery Habitat
(maximum 100 points) _____

4.2.7.2 Migration and Staging Habitat

Step 1:

☐	Staging or Migration Habitat is not present in the wetland	Go to Step 4, Score 0 points
☐	Staging or Migration Habitat is present in the wetland, significance of the habitat is known	Go to Step 2
☐	Staging or Migration Habitat is present in the wetland, significance of the habitat is not known	Go to Step 3

Step 2: Select the highest appropriate category below. Ensure that documentation is attached to the data record.

☐	Significant in Ecoregion	Score 25 points in Step 4
☐	Significant in Ecodistrict	Score 15 points in Step 4
☐	Locally Significant	Score 10 points in Step 4
☐	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

Step 3: Select the highest appropriate category below based on presence of the designated site type (i.e. does not have to be the dominant site type). Note name of river for ones within 0.75 km of rivermouth.

☐	Wetland is riverine at rivermouth or lacustrine at rivermouth	Score 25 points in Step 4
☐	Wetland is riverine, within 0.75 km of rivermouth	Score 15 points in Step 4
☐	Wetland is lacustrine, within 0.75 km of rivermouth	Score 10 points in Step 4
☐	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

Step 4: Enter a score from only one of the three above Steps.

Score for Staging and Migration Habitat
(maximum score 25 points) _____

4.3 ECOSYSTEM AGE

(Fractional Area = Area of wetland type/total area of wetland)

		Fractional Area		Score
Bog	=		x 25 =	
Fen, treed to open on deep soils, floating mats or marl	=		x 20 =	
Fen, on limestone rock	=		x 5 =	
Swamp	=		x 3 =	
Marsh	=		x 0 =	
	Total		=	

Ecosystem Age Score *(maximum 25 points)* _____

4.4 GREAT LAKES COASTAL WETLANDS

Choose one only.

	Wetland < 10 ha	=	10 pts
	Wetland 10-50 ha	=	25
	Wetland 51-100 ha	=	50
	Wetland > 100 ha	=	75

Great Lakes Coastal Wetland Score
(maximum 75 points) _____

GENERAL INFORMATION

Wetland Evaluator(s)

Name: _____ Affiliation: _____

Signature: _____

(by signing, I confirm that this evaluation has been undertaken and completed in accordance with the Ontario Wetland Evaluation System Southern Manual 4th Edition / Northern Manual 2nd Edition)

Name: _____ Affiliation: _____

Signature: _____

(by signing, I confirm that this evaluation has been undertaken and completed in accordance with the Ontario Wetland Evaluation System Southern Manual 4th Edition / Northern Manual 2nd Edition)

Name: _____ Affiliation: _____

Signature: _____

(by signing, I confirm that this evaluation has been undertaken and completed in accordance with the Ontario Wetland Evaluation System Southern Manual version 4 / Northern Manual version 2)

Name: _____ Affiliation: _____

Signature: _____

(by signing, I confirm that this evaluation has been undertaken and completed in accordance with the Ontario Wetland Evaluation System Southern Manual 4th Edition / Northern Manual 2nd Edition)

Name: _____ Affiliation: _____

Signature: _____

(by signing, I confirm that this evaluation has been undertaken and completed in accordance with the Ontario Wetland Evaluation System Southern Manual 4th Edition / Northern Manual 2nd Edition))

Date(s) wetland visited (in field): _____

Date evaluation completed: _____

Estimated time devoted to completing the field survey in person hours: _____

Weather Conditions

i) at time of field work: _____

ii) summer conditions in general: _____

WETLAND EVALUATION SCORING RECORD

WETLAND NAME _____

1.0 BIOLOGICAL COMPONENT

_____ 1.1 PRODUCTIVITY
_____ 1.1.1 Growing Degree-Days/Soils
_____ 1.1.2 Wetland Type
_____ 1.1.3 Site Type

_____ Total for Productivity

_____ 1.2 BIODIVERSITY
_____ 1.2.1 Number of Wetland Types
_____ 1.2.2 Vegetation Communities *(maximum 45)*
_____ 1.2.3 Diversity of Surrounding Habitat *(maximum 7)*
_____ 1.2.4 Proximity to Other Wetlands
_____ 1.2.5 Interspersion
_____ 1.2.6 Open Water Type

_____ Total for Biodiversity

_____ 1.3 SIZE (Biological Component)

_____ TOTAL FOR BIOLOGICAL COMPONENT *(not to exceed 250)*

2.0 SOCIAL COMPONENT

_____ 2.1 ECONOMICALLY VALUABLE PRODUCTS
_____ 2.1.1 Wood Products
_____ 2.1.2 Low Bush Cranberry
_____ 2.1.3 Wild Rice
_____ 2.1.4 Commercial Baitfish
_____ 2.1.5 Furbearers

_____ Total for Economically Valuable Products

_____ 2.2 RECREATIONAL ACTIVITIES *(maximum 80)*

_____ 2.3 LANDSCAPE AESTHETICS
_____ 2.3.1 Distinctness
_____ 2.3.2 Absence of Human Disturbance

_____ Total for Landscape Aesthetics

_____ 2.4 EDUCATION AND PUBLIC AWARENESS
_____ 2.4.1 Educational Uses
_____ 2.4.2 Facilities and Programs
_____ 2.4.3 Research and Studies

_____ Total for Education and Public Awareness

_____ 2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT

_____ 2.6 OWNERSHIP

_____ 2.7 SIZE (Social Component)

_____ 2.8 ABORIGINAL AND CULTURAL VALUES

_____ TOTAL FOR SOCIAL COMPONENT *(not to exceed 250)*

3.0 HYDROLOGICAL COMPONENT

_____ 3.1 FLOOD ATTENUATION

3.2 GROUNDWATER RECHARGE

_____ 3.2.1 Site Type

_____ 3.2.2 Soil Recharge Potential

_____ Total for Groundwater Recharge

3.3 WATER QUALITY IMPROVEMENT

_____ 3.3.1 Watershed Improvement Factor

_____ 3.2.2 Adjacent and Watershed Land Use

_____ 3.2.3 Vegetation Form

_____ Total for Water Quality Improvement

_____ 3.4 CARBON SINK

_____ 3.5 SHORELINE EROSION CONTROL

_____ 3.6 GROUNDWATER DISCHARGE *(maximum 30)*

_____ TOTAL FOR HYDROLOGICAL COMPONENT *(not to exceed 250)*

4.0 SPECIAL FEATURES

4.1 RARITY

_____ 4.1.1 Wetlands

4.1.2 Species

_____ 4.1.2.1 Provincially Significant Animals
_____ 4.1.2.2 Provincially Significant Plants
_____ 4.1.2.3 Regionally Significant Species
_____ 4.1.2.4 Locally Significant Species
_____ 4.1.2.5 Species of Special Status

_____ Total for Species Rarity

4.2 SIGNIFICANT FEATURES OR HABITAT

_____ 4.2.1 Colonial Waterbirds
_____ 4.2.2 Winter Cover for Wildlife
_____ 4.2.3 Waterfowl Staging and Moulting
_____ 4.2.4 Waterfowl Breeding
_____ 4.2.5 Migratory Passerine, Shorebird or Raptor Stopover
_____ 4.2.6 Ungulate Habitat
_____ 4.2.7 Fish Habitat

_____ Total for Significant Features and Habitat

_____ 4.3 ECOSYSTEM AGE

_____ 4.4 GREAT LAKES COASTAL WETLANDS

_____ TOTAL FOR SPECIAL FEATURES *(not to exceed 250)*

SUMMARY OF EVALUATION RESULT

Wetland _____

_____ 1.0 TOTAL FOR BIOLOGICAL COMPONENT

_____ 2.0 TOTAL FOR SOCIAL COMPONENT

_____ 3.0 TOTAL FOR HYDROLOGICAL COMPONENT

_____ 4.0 TOTAL FOR SPECIAL FEATURES COMPONENT

_____ TOTAL WETLAND SCORE

APPENDICES

APPENDIX 1 – PROVINCIALLY SIGNIFICANT WETLANDS

OWES evaluations are provided to decision makers addressing land use planning, development and resource management matters. The ministry has determined that a wetland is provincially significant when it has been identified as such using this manual. In Ontario, there are two evaluation manuals – one for the area generally south of the southern edge of the Canadian Shield (encompassing Hills Site Regions 6 & 7) and one for the area north of this line (encompassing Hills Site Regions 2 through 5). Both manuals provide direction for gathering data on an assortment of functions and values of wetlands which are divided into four categories (biological, social, hydrological and special features. These functions and values are assigned numerical scores which cannot exceed 250 points in any category or 1000 points overall.

DEFINITION

For both northern and southern Ontario a provincially significant wetland is any wetland that:

1. Achieves a total score of 600 or more points, or

2. Achieves a score of 200 or more points in either the Biological component or the Special Features component.

APPENDIX 2 – LIST OF MAPPING RESOURCES FOR USE IN WETLAND EVALUATIONS

The following sources may be useful to evaluators when undertaking a wetland evaluation. Note: Regardless of which sources may be used, wetland mapping and identification standards outlined in this OWES manual must be followed when determining wetland significance.

- **Land Information Ontario**
  Through partnerships and collaboration, Land Information Ontario (LIO) manages key provincial datasets. Imagery and GIS layers for Ontario infrastructure (e.g., roads, utility corridors, etc.), contours, watersheds, wetlands, soils, and more are available through Land Information Ontario (http://www.mnr.gov.on.ca/en/Business/LIO/index.html)

- **Canada Land Inventory (CLI)**
  A comprehensive land inventory of rural Canada, showing land capability for agriculture, forestry, wildlife, and recreation. Maps available from Natural Resources Canada at: http://geogratis.cgdi.gc.ca

- **Agricultural Land Use Systems Maps**
  Maps organized by township at a scale of 1:50,000, indicate the variation in land use systems and non-use systems. Maps can be ordered from: http://www.omafra.gov.on.ca/english/products/soils.html

- **National Topographic System (NTS)**
  Provides general-purpose topographic map coverage of Canada. Maps depict ground relief (landforms and terrain), drainage (lakes and rivers), forest cover, administrative areas, populated areas, transportation routes and facilities (including roads and railways), and other man-made features. For more information visit: http://maps.nrcan.gc.ca/topo_e.php

- **Orthophotography**
  Aerial photographs that have been geometrically corrected so the scale of the photograph is uniform, meaning the photo can be considered the equivalent of a map. Unlike an aerial photograph, an orthophoto can be used to measure true distances. Orthophotos are available for various areas across the province – several municipalities/cities have orthophoto coverage. Orthophotos are digital and can be viewed at different scales. The photos are mostly taken in the spring "leaf-off" conditions and are thus good for determining the maximum extent of open water and wetland boundaries, particularly swamps.

- **Colour Infrared Air Photos (CIR)**
  Air photos taken using "near infrared" film. Coverage includes most areas in southern Ontario at a scale of approximately 1:10,000. CIR photos are taken in the summer during "leaf-on" conditions, and thus may make it more difficult to distinguish swamps from upland forest. CIR photos are useful for identifying aquatic submerged and floating vegetation. Different colours in the CIR photos allow one to distinguish graminoid marsh from cattail marsh, thicket swamp, and coniferous, mixed and deciduous swamps.

- **Black and White Air Photos**
  Taken using black and white film. Photos cover most of Ontario. CIR photos can be ordered from: http://www.mnr.gov.on.ca/mnr/mapmenu.html

- **Surficial and Bedrock Geology Maps**
  Maps published by the Ontario Geological Survey pertaining to surficial geology and industrial mineral and aggregate resources and pertaining to bedrock geology and related metallic mineral and petroleum resources. Maps can be ordered from: http: www.geologyontario.mndm.gov.on.ca

- **Southern Ontario Land Resource Information System (SOLRIS)**
  A landcover inventory of southern Ontario's natural, rural and urban areas. Contact the Ministry of Natural Resources and/or Land Information Ontario for more information.

APPENDIX 3 – LIST OF FIELD GUIDES, MANUALS AND USEFUL REFERENCES

AMPHIBIANS & REPTILES

Conant, R. and J.T. Collins. 1998. A Field Guide to Reptiles and Amphibians: Eastern and Central North America. Peterson Field Guide Series, Houghton Mifflin Company, Buffalo. 616 pp.

Cook, F.R. 1984. Introduction to Canadian Amphibians and Reptiles. National Museum of Natural Sciences, Ottawa. 200pp.

Harding, J.H. 1997. Amphibians and Reptiles of the Great Lakes Region. University of Michigan Press, Ann Arbor.378 pp.

Johnson, R. 1989. Familiar Reptiles and Amphibians of Ontario. Natural Heritage/ Natural History Inc., Toronto, Ont. 168pp.

MacCulloch, R.D. 2002. The ROM Field Guide to Amphibians and Reptiles of Ontario. Royal Ontario Museum, Toronto, ON. 168 pp.

Ontario Reptile and Amphibian Atlas: http://www.ontarionature.org/protect/species/herpetofaunal_atlas.php

Tennant, A., Bartlett, RD and GT Salmon. 2002. A Field Guide to Snakes of North America: Eastern and Central Regions. Gulf Publishing, Houston.

AQUATIC ECOLOGY

Keddy, P. A. 2010. Wetland Ecology: Principles and Conservation. Cambridge University Press. 516 pages.

Klots, E. B. 1966. The New Field Guide of Freshwater Life. Longmans Canada Limited, Toronto. 398 pp.

Needham, J.G. and P.R. Needham. 1962. A Guide to the Study of Freshwater Biology. Holden-Day Inc., San Francisco.

Niering, W.A. 1998. Wetlands. National Audubon Society Nature Guides, Alfred A. Knopf, NY. 638 pp.

BIRDS

Baicich P.J. and C.J.O. Harrison. 1997. A Guide to the Nests, Eggs and Nestlings of North American Birds, second edition. Academic Press, San Diego. 347 pp.

Bezener, A. 2000. Birds of Ontario. Lone Pine Publishing, Edmonton, AB. 376 pp.

Cadman, M.D., P.F.J. Eagles and F.M. Helleiner. 1987. Atlas of the Breeding Birds of Ontario. University of Waterloo Press, Waterloo, Ontario.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.

Crossley, R. 2011. The Crossley ID Guide, Eastern Birds. Princeton University Press, Princeton, New Jersey. 529 pp.

Dunn, J.L. and Alderfer, J. 2011. National Geographic Field Guide to the Birds of North America, Sixth Edition

Earley, C.G. 2003. Sparrows and Finches of the Great Lakes Region and Eastern North America. Firefly Books Ltd., Buffalo, NY. 128 pp.

Earley, C.G. 2003. Warblers of the Great Lakes Region and Eastern North America. Firefly Books Ltd., Buffalo, NY. 131 pp.

Earley, C.G. 2004. Hawks and Owls of the Great Lakes Region and Eastern North America. Firefly Books Ltd, Buffalo, NY. 128 pp.

Earley, C.G. 2005. Waterfowl of Eastern North America. Firefly Books Ltd., Buffalo, NY. 158 pp.

Fisher, C., and G Ross. 1997. Ontario Birds. Lone Pine Publishing, Edmonton 160 pp.

Godfrey, Earl W. 1986. The Birds of Canada (Revised Edition). The National Museum of Natural Sciences. Ottawa.

James, R.D. 1991. Annotated Checklist of the Birds of Ontario. 2nd edition. Life Sciences Miscellaneous Publications, Royal Ontario Museum, Toronto, Ontario. 128 pp. Available online: www.biodiversitylibrary.org.

Kaufman, K. 1990. A Field Guide to Advanced Birding: Birding Challenges and How to Approach Them. Peterson Field Guide Series, Houghton Mifflin Company, Buffalo. 299 pp.

O'Brien, M, R. Crossley, and K. Karlson. 2006. The Shorebird Guide. Houghton Mifflin Company, Boston. 477 pp.

Peterson, R.T. 1980. A Field Guide to the Birds of Eastern and Central North America. Peterson Field Guide Series, Houghton Mifflin Co., Boston. 384 pp.

Sandilands, A. 2007. Birds of Ontario: Habitat Requirements, Limiting Factors, and Status: Nonpasserines: Waterfowl Through Cranes. UBC Press, 368 pp.

Sandilands, A. 2010. Birds of Ontario: Habitat Requirements, Limiting Factors, and Status: Nonpasserines: Shorebirds Through Woodpeckers. UBC Press, 387 pp.

Sibley, D.A. 2000. The Sibley Guide to Birds. National Audubon Society, Alfred A. Knopf, New York. 544 pp.

FISH

Holm, E, Mandrak, N. and M. Burridge. 2008. The ROM Field Guide to Freshwater Fishes of Ontario. Royal Ontario Museum, Toronto, ON. 432 pp.

Hubbs, C.L. and K.K. Lagler. 2004. Fishes of the Great Lakes Region. Revised Edition. University Michigan Press, Ann Arbor, Michigan. 199 pp.

Mandrak, N.E. and E.J. Crossman. 1992. A Checklist of Ontario Freshwater Fishes: Annotated with Distribution Maps. Royal Ontario Museum, Toronto, 176 pp.

McAllister, D.A., and B.W. Coad. 1974. Fishes of Canada's National Capital Region. National Museum of Natural Sciences, Ottawa. 200 pp.

Page, L.M. and B.M. Burr. 1991. A Field Guide to Freshwater Fishes: North America North of Mexico. Peterson Field Guide Series, Houghton Mifflin Company, Buffalo. 432 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Bulletin 184. Fisheries Research Board of Canada. 966 pp.

INVERTEBRATES

Beadle, D. and S. Leckie. 2012. Peterson Field Guide to Moths of Northeastern North America. Houghton Mifflin Harcourt, Boston, 624 pp.

Borror, D.J. and R.E. White. 1970. A Field Guide to Insects: America North of Mexico. Peterson Field Guide Series, Houghton Mifflin Company, Buffalo. 404 pp.

Borror, D.J., C.A. Triplehorn and N.F. Johnson. 1989. An Introduction to the Study of Insects, Sixth Edition. Saunders College Publishing, New York. 875 pp.

Carmicheal, I. 2002. Photo Field Guide to the Dragonflies and Damselflies of Southwestern Ontario. The Friends of Pinery Park, Grand Bend, ON. 72 pp.

Catling, P.M. and V.R. Brownell. 2000. Damselflies and Dragonflies (Odonata) of Ontario: Resource Guide and Annotated List. ProResources, 2326 Scrivens Drive, Metcalfe, Ontario,

Canada. 200 pp. Available online: http://www.ontarioinsects.org/publications.htm

Clark, Arthur H. 1981. The Freshwater Molluscs of Canada. National Museum of Natural Sciences, Ottawa. 446 pp.

Crocker, D.W. and D.W. Barr. 1968. The Crayfishes of Ontario. Royal Ontario Museum, Toronto. 158 pp. (available online www.biodiversitylibrary.org)

Dillon, R. T., Jr., B. T. Watson, T. W. Stewart, W. K. Reeves & M. Kohl 2011. The freshwater gastropods of North America Internet address: http://www.fwgna.org [Species List with photos and text at: http://www.fwgna.org/species.html]

DuBois, B. 2005. Damselflies of the North Woods. Kollath-Stensaas Publishing, Duluth, MN. 132 pp.

Dunkle, S.W. 2000. Dragonflies through Binoculars: A Field Guide to Dragonflies of North America. Oxford University Press, Oxford. 266 pp.

Eaton, ER., and K. Kaufman. 2007. Kaufman Field Guide to Insects of North America. Houghton Mifflin Harcourt, Boston 392 pp.

Grimm, F.W., R.G. Forsyth, F.W. Schueler, and A. Karstad. 2009. Identifying Land Snails and Slugs in Canada. Canadian Food Inspection Agency. 168 pp.

Holmes, A.M., Q.F. Hess, R.R. Tasker and A.J. Hanks. 1991. The Ontario Butterfly Atlas. Toronto Entomologists' Association, Toronto. 167 pp.

Jones, C.D., A. Kingsley, P. Burke, and M. Holder. 2008. Field Guide to The Dragonflies and Damselflies of Algonquin Provincial Park and the Surrounding Area. The Friends of Algonquin Park. 263 pp.

Jones, C., Layberry, R., and A. Macnaughton. Ontario Butterfly Atlas Online. Toronto Entomologists' Association: http://www.ontarioinsects.org/atlas_online.htm

Lam, E. 2004. Damselflies of the Northeast: A Guide to the Species of Eastern Canada & the Northeastern United States. Biodiversity Books, 96 pp.

Layberry, R.A., P.W. Hall and J.D. Lafontaine. 1998. The Butterflies of Canada. Univeristy of Toronto Press Inc., Toronto. 280 pp. Available online: http://www.cbif.gc.ca/spp_pages/butterflies/index_e.php

Marshall, S.A. 2006. Insects: Their Natural History and Diversity, with a photographic guide to insects of eastern North America. Firefly Books Ltd., Richmond Hill, ON. 718 pp.

Mead, K. 2003. Dragonflies of the North Woods. Kollath-Stensaas Publishing, Duluth, MN. 203 pp.

Merritt, R.W. and K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America, Third Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 pp.

Metcalfe-Smith, J., A. MacKenzie, I. Carmichael and D. McGoldrick. 2005. Photo Field Guide to the Freshwater Mussels of Ontario. St. Thomas Field Naturalists Club, St. Thomas, ON. 60 pp.

Opler, P. 1998. A Field Guide to Eastern Butterflies. Peterson Field Guide Series, Houghton Mifflin Company, Buffalo. 486 pp.

Paulson, D. 2011. Dragonflies and Damselflies of the East.. Princeton University Press, Princeton 576 pp.

Pearson, D.L., C.B. Knisley and C.J. Kazilek. 2006. A Field Guide to the Tiger Beetles of the United States and Canada: Identification, Natural History and Distribution of the Cicindelidae. Oxford University Press, Oxford. 227 pp.

Pennak, R.W. 1989. Fresh-water Invertebrates of the United States: Protozoa to Mollusca. John Wiley & Sons, Inc. 628 pp.

Riotte, J.C.E. 1992. Annotated List of Ontario Lepidoptera. Life Science Miscellaneous Publications. Royal Ontario Museum, Toronto, Ontario. Available online: (available online www.biodiversitylibrary.org.

Smith, D.G. 2001. Pennak's Freshwater Invertebrates of the United States: Porifera to Crustacea, 4th Edition. John Wiley & Sons, Inc.

Wagner, DL. 2005. Caterpillars of Eastern North America: A Guide to Identification and Natural History. Princeton University Press, Princeton NJ 496 pp.

White, R.E. 1983. A Field Guide to the Beetles of North America. Peterson Field Guide Series, Houghton Mifflin Co., Boston. 368 pp.

MAMMALS

Banfield, A.W.F. 1974. The Mammals of Canada. National Museum of Natural Sciences and U. of Toronto Press. 438 pp.

Dobbyn, J. (Sandy). 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists, Toronto, ON. viii + 75 pp. Available online: http://www.ontarionature.org/discover/resources/publications.php#atlases

Eder, T. 2002. Mammals of Ontario. Lone Pine Publishing, Edmonton, AB. 215 pp.

Whitaker, J.O. Jr. 1980. The Audubon Society Field Guide to North American Mammals. Chanticleer Press, N.Y. 745 pp.

van Zyll de Jong, C.G. 1983. Handbook of Canadian Mammals 1. Marsupials and Insectivores. National Museum of Natural Sciences, National Museums of Canada, Ottawa. 210 pp.

van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. 2. Bats. National Museum of Natural Sciences, National Museums of Canada,Ottawa. 212 pp.

PLANTS

Argus, G.W., K.M. Pryer, D.J. White, and C.J. Keddy (editors). 1982-1987. Atlas of the Rare Vascular Plants of Ontario. Four Parts. National Museum of Natural Sciences, Ottawa. Looseleaf. Available online: www.biodiversitylibrary.org.

Barkworth, M.E., K.M. Capels, M.B. Piep, and S. Long (eds.). 2007. Manual of North American Grasses. Intermountain Herbarium and Utah State University Press, Logan, Utah. 627 pp.

Boivin, B. 1992. Les Cyperaceae de l'est du Canada. Provancheria, Memoire de L'Herbier Lois-Marie No. 25. Université Laval, Québec, PQ. 230 pp. Available online : http://www.herbier.ulaval.ca/provancheria/pr25.pdf

Brodo, I.M., S.D. Sharnoff and S. Sharnoff. 2001. Lichens of North America. Yale Univeristy Press, New Haven. 795 pp.

Brown, L. 1976. Wildflowers and Winter Weeds. WW. Norton and Company, NY. 252 pp.

Brown, L. 1979. Grasses: An Identification Guide. Houghton Mifflin Company, Boston. 240 pp.

Chambers, B., Legasy, K. and CV Bentley. 1996. Forest Plants of Central Ontario. Lone Pine Publishing, Edmonton. 448 pp.

Cobb, B., E. Farnsworth and C. Lowe. 2005. Peterson Field Guide to Ferns: Northeastern and Central North America, 2nd Edition. Houghton Mifflin Co, Boston. 417 pp.

Cody, W.J. and D.L. Britton. 1989. The Ferns and Fern Allies of Canada. Research Branch, Agriculture Canada, Ottawa. Publication No. 1829/E. 430 pp. Available online: www.biodiversitylibrary.org.

Cronk, J.K. and Hennessy, M.S. 2001. Wetland Plants, Biology and Ecology. Lewis Publishers, Washington D.C.

Crowe, GE. and CB Hellquist. 2000. Aquatic and Wetland Plants of Northeastern North America, Volume 1: Pteridophytes, Gymnosperms and Angiosperms Dicotyledons. University of Wisconsin Press, Wisconsin 480 pp.

Crowe, GE. and CB Hellquist. 2000. Aquatic and Wetland Plants of Northeastern North America, Volume 2: Angiosperms: Monocotyledons. University of Wisconsin Press, Wisconsin 400 pp.

Crum, H. 1983. Mosses of the Great Lakes Forest. Third Edition. University of Michigan Herbarium, Ann Arbor. 417 pp.

Crum, H. 1988. A Focus on Peatlands and Peat Mosses. Unviersity of Michigan Press, Ann Arbor. 306 pp.

Crum, H. 1991. Liverworts and Hornworts of Southern Michigan. University of Michigan Herbarium, Ann Arbor. 233 pp.

Dickinson, T., D. Metsger, J. Bull and R. Dickinson. 2004. The ROM Field Guide to Wildflowers of Ontario. Royal Ontario Museum, Toronto, ON. 416 pp.

Farrar, J.L. 1995. Trees in Canada. Fitzhenry & Whiteside Ltd and Canadian Forest Services. 502 pp.

Fassett, N. C. 1997. Grasses Of Wisconsin: Taxonomy, Ecology, & Distribution Of The Gramineae. Univ. of Wisconsin Press. Madison, WI.

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ vols. New York and Oxford. Vol. 1, 1993; vol. 2, 1993; vol. 3, 1997; vol. 4, 2003; vol. 5, 2005; vol. 19, 2006; vol. 20, 2006; vol. 21, 2006; vol. 22, 2000; vol. 23, 2002; vol. 25, 2003; vol. 26, 2002. (see also http://www.efloras.org/flora_page.aspx?flora_id=1)

Frankton, C. and G.A. Mulligan. 1970. Weeds of Canada, Canada Dept. of Agriculture, Ottawa, Ontario.

Gleason, H.A. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and adjacent Canada. 3 volumes. Hafner Press, New York.

Gleason, H.A., and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. New York Botanical Garden, Bronx, New York. 910 pp.

Harris, AG., Kershaw, L. and SG Newmaster. 2007. Wetland Plants of Ontario. Lone Pine Publishing, Edmonton 240 pp.

Hipp, A.L. with illustrations by R.D. Davis, maps and appendices by T.S. Cochrane and M. Black. 2008. Field Guide to Wisconsin Sedges: An Introduction to the Genus Carex (Cyperaceae). University of Wisconsin Press, Madison. 280 pages.

Holmgren, N.H. 1998. Illustrated companion to Gleason and Cronquist's manual: illustrations of the vascular plants of northeastern United States and adjacent Canada. New York Botanical Garden, Bronx, New York. 937 pp.

Hotchkiss, N. 1967. Underwater and Floating-leaved Plants of the United States and Canada. U.S. Bureau of Sport Fisheries and Wildlife, Washington, D.C.

Ireland, R.R. and L.M. Ley. 1992. Atlas of Ontario Mosses. Canadian Museum of Nature, Syllogeus No. 70, Ottawa. 138 pp. (available online www.biodiversitylibrary.org)

Johnson, D., L. Kershaw, A. MacKinnon and J. Pojar. 1995. Plants of the Western Boreal Forest and Aspen Parkland. Lone Pine Publishing, Edmonton, AB. 392 pp.

Kershaw, L. 2001. Trees of Ontario. Lone Pine Publishing, Edmonton, AB. 240 pp.

Kershaw, L. 2002. Ontario Wildflowers: 101 Wayside Flowers. Lone Pine Publising, Edmonton 144 pp.

Legasy, K. 1995. Forest Plants of Northeastern Ontario. Lone Pine Publishing, Edmonton 252 pp.

Ley, L.M. and J.M. Crowe. 1999. An Enthusiast's Guide to the Liverworts and Hornworts of Ontario. Lakehead University, Thunder Bay, Ontario. 135 pp.

McKenny, M. and RT Peterson. 1998. A Field Guide to Wildflowers: Northeastern and North-Central North America. Peterson Field Guides: Houghton Mifflin Harcourt, Boston 448 pp.

McKnight, KH and VB McKnight. 1998. A Field Guide to Mushrooms: North America. Peterson Field Guides: Houghton Mifflin Harcourt, Boston 448 pp.

McQueen, CB. 2000. Field Guide to the Peat Mosses of Boreal North America. University Press of New England. Lebanon, NH 138 pp

Morton, J.K and J.M. Venn. 2000. The Flora of Manitoulin Island. Third Revised Edition. University of Waterloo Biology Series No. 40. Department of Biology, University of Waterloo, Ontario N2L 3G1. 376 pp.

Morton, J.K and J.M. Venn. 1990. A checklist of the Flora of Ontario Vascular Plants. University of Waterloo Biology Series No. 34. Department of Biology, University of Waterloo, Waterloo, Ontario N2L 3G1 218 pp.

Newcomb, L. 1977. Newcomb's Wildflower Guide. Little, Brown and Company, Boston and Toronto.

Newmaster, S.G., A. Lehela, P.W.C. Uhlig, S. McMuray, and M.J. Oldham. 1998. Ontario Plant List. Ontario Forest Research Institute, Sault Ste. Marie, Ontario, Forest Research Information Paper No. 123. 650 pp. + appendices.

Niering, W.A. 1998. Field Guide to North American Wildflowers: Eastern Region. National Audubon Society, Alfred A. Knopf, New York. 887 pp.

Oldham, M.J. and S.R. Brinker. 2009. Rare Vascular Plants of Ontario. Fourth Edition. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, Ontario. 188 pp. Available online: http://publicdocs.mnr.gov.on.ca/View.asp?Document_ID=15769&Attachment_ID=33301

Peterson, R.T. and M. Mckenny. 1968. A Field Guide to Wildflowers: Northeastern/Northcentral North America. Houghton Mifflin Co., Boston.

Petrides, G.A. and J. Wehr 1988. Eastern Trees. Peterson Field Guide Series, Houghton Mifflin Company, Boston. 424 pp.

Semple, J.C., G.S. Ringius, and J. J. Zhang. 1999. The Goldenrods of Ontario: Solidago L. and Euthamia Nutt. Third Edition. University of Waterloo Biology Series No. 39. Department of Biology, University of Waterloo, Waterloo, Ontario N2L 3G1. 90 pp.

Semple, J. C., S. B. Heard, and L Brouillet. 2002. Cultivated and Native Asters of Ontario (Compositae: Astereae): Aster L. (including Asteromoea Blume, Diplactis Raf. and Kalimeris (Cass.) Cass.), Callistephus Cass., Galatella Cass., Doellingeria Nees, Oclemena E.L. Greene, Eurybia (Cass.) S.F. Gray, Canadanthus Nesom, and Symphyotrichum Nees (including Virgulus Raf.). University of Waterloo Biology Series 41: 134 pp. Department of Biology, University of Waterloo, Waterloo

Smith, W.R. 2008. Trees and Shrubs of Minnesota: The Complete Guide to Species Identification. University of Minnesota Press, Minneapolis. 703 pp.

Soper, J.H. and M.L. Heimburger. 1982. Shrubs of Ontario. Life Sciences Misc. Publications. Royal Ontario Museum, Toronto. 495 pp. Available online www.biodiversitylibrary.org.

Voss, E. G., and A. A. Reznicek. 2012. Field Manual of Michigan Flora. University of Michigan Press, Ann Arbor. 990 pp. See also the Michigan Flora Online: http://www.michiganflora.net/.

Walewski, J. 2007. Lichens of the North Woods. Kollath-Stensaas Publishing, Duluth MN 160 pp.

Wojtech, M. 2011. Bark: A Field Guide to Trees of the Northeast. UPNE, Wellfleet, MA. 280 pp.

SOILS

Brady, N.C. and R. R. Weil. 2008. The Nature and Properties of Soils (14th ed.). Prentice Hall, Upper Saddle River, NJ. 975 pp.

Richardson, J.L and M.J. Vepraskas. 2001. Wetland Soils: Genesis, Hydrology, Landscapes and Classification. CRC Press, Boca Raton, FL. 417 pp.

APPENDIX 4 – WETLAND DATA SUMMARY FORM

Complete versions of the data form in this appendix should be attached to the wetland data record and included within the wetland evaluation file.

Wetland Name____ Page _______ of _______

Map Code	Field Code	GPS Coordinate	Dominant Form	Forms	# Forms	Dominant Species	Area	% Open Water			Open Water	Soil	Site Type	Fish Habitat			
								Low (ha)	High Est.	Mean Est.		(ha)		% Fish Habitat	Area (ha)	Habitat Type	Key Veg Group

APPENDIX 5 – REGIONALLY SIGNIFICANT BIRD SPECIES

Regionally rare breeding bird species were based on an analysis of data from the Atlas of Breeding Birds of Ontario (Cadman *et al.* 1987) based on Hills' Site Regions, now ecoregions. This information was updated in 1999 through a review by the Natural Heritage Information Centre, as well as by specialists with expertise in breeding birds for their areas. Users should keep in mind that such lists are dynamic entities and species status may change for many reasons. From time to time, the person responsible for the wetland evaluation should ensure that the species status is still valid by consulting with the appropriate experts and maintaining documentation on file.

Regionally Significant Breeding Birds in Region 2

Arctic Loon	Northern Phalarope	Veery
Pied billed Grebe	Arctic Tern	Gray Catbird
Snow Goose	Mourning Dove	Brown Thrasher
Wood Duck	Black billed Cuckoo	Northern Parula
Northern Shoveler	Great Horned Owl	Black throated Blue Warbler
Lesser Scaup	Barred Owl	Blackburnian Warbler
Bufflehead	Downy Woodpecker	Connecticut Warbler
Hooded Merganser	Pileated Woodpecker	Rose breasted Grosbeak
Goshawk	Eastern Phoebe	Clay coloured Sparrow
Merlin	Eastern Kingbird	LeConte's Sparrow
Sharp tailed Grouse	Horned Lark	Sharp tailed Sparrow
Sora	Cliff Swallow	Bobolink
Semipalmated Plover	Blue Jay	Brown headed Cowbird
Least Sandpiper	House Wren	Pine Grosbeak
American Woodcock	Sedge Wren	Red Crossbill
	Marsh Wren	

Regionally Significant Breeding Birds in Region 3

Pied-Billed Grebe
Wood Duck
Green-Winged Teal
Pintail
Northern Shoveler
American Wigeon
Lesser Scaup
Goshawk
Sharp-tailed Grouse
Virginia Rail
Sora
Sandhill Crane
Greater Yellowlegs
Mourning Dove
Black-billed Cuckoo
Great Horned Owl
Barred Owl
Whip-poor-will
Chimney Swift
Three-toed Woodpecker
Eastern Wood-pewee
Eastern Phoebe
Great-crested Flycatcher
Horned Lark
Northern Rough-winged Swallow
White-breasted Nuthatch
House Wren
Sedge Wren
Wood Thrush
Gray Catbird
Brown Thrasher
Warbling Vireo
Orange-crowned Warbler
Black-throated Blue Warbler
Pine Warbler
Blackpoll Warbler
Connecticut Warbler
Bobolink
Eastern Meadowlark
Northern Oriole
Rusty Blackbird
Brewer's Blackbird
Scarlet Tanager
Northern Cardinal
Indigo Bunting
Pine Grosbeak
Red Crossbill
Clay-coloured Sparrow
Vesper Sparrow
LeConte's Sparrow
Fox Sparrow

Regionally Significant Breeding Birds in Region 4

Pied-Billed Grebe
Green-Backed Heron
Pintail
Northern Shoveler
American Wigeon
Lesser Scaup
Goshawk
Sharp-tailed Grouse
Sandhill Crane
Greater Yellowlegs
Upland Sandpiper
Bonaparte's Gull
Common Tern
Yellow-billed Cuckoo
Eastern Screech Owl
Boreal Owl
Three-toed Woodpecker
Willow Flycatcher
Horned Lark
Purple Martin
Northern Rough-winged Swallow
House Wren
Sedge Wren
Marsh Wren
Wood Thrush
Eastern Bluebird
Yellow-throated Vireo
Warbling Vireo
Golden-winged Warbler
Black-throated Blue Warbler
Palm Warbler
Connecticut Warbler
Eastern Meadowlark
Brewer's Blackbird
Northern Cardinal
Rufous-sided Towhee
Pine Grosbeak
Red Crossbill
Clay-coloured Sparrow
Vesper Sparrow
LeConte's Sparrow

Regionally Significant Breeding Birds in Region 5

Pintail
Northern Shoveler
American Wigeon
Lesser Scaup
Sharp-tailed Grouse
Common Moorhen
Sandhill crane
Solitary Sandpiper
Yellow-billed Cuckoo
Eastern Screech Owl
Three-toed Woodpecker
Willow Flycatcher
Horned Lark
Boreal Chickadee
Marsh Wren
Blue-gray Gnatcatcher
Orange-crowned Warbler
Palm Warbler
Connecticut Warbler
Wilson's Warbler
Northern Cardinal
Clay-coloured Sparrow
Grasshopper Sparrow
LeConte's Sparrow
Sharp-tailed Sparrow

APPENDIX 6 – REFERENCES FOR REGIONALLY AND LOCALLY SIGNIFICANT PLANT SPECIES

The following references may be used in the designated Site Districts for scoring **locally** significant plant species. For other MNR Regions, regionally significant plant species cannot be scored until appropriate lists or an appropriate specialist is identified.

Site District 4E-1

Brunton, D.F. 1991. Checklist of vascular plants: Lake Superior Provincial Park. (2nd ed.) Ontario Ministry of Natural Resources, Wawa, Ontario.

Site District 4W-1

Walshe, S. 1980. Plants of Quetico and the Ontario Shield. Univ. of Toronto Press, Toronto, Ontario.

Site Districts 5E-9 and 5E-10

Brunton, D.F. and W.J. Crins. 1992. Checklist of the vascular plants of Algonquin Park. (Revised) Algonquin Park Technical Bulletin No. 4.

Site District 5E-2

Morton, J. K. and J.M. Venn. 1987. The flora of Manitoulin Island. (Second revised edition). University of Waterloo Biology Series No. 31. Dept. of Biology, University of Waterloo, Waterloo, Ontario.

Haliburton County

Skelton, E.G. and E.W. Skelton. 1991. Haliburton flora: An annotated list of the vascular plants of the county of Haliburton, Ontario. Royal Ontario Museum Life Sciences Miscellaneous Publications, Royal Ontario Museum, Toronto, Ontario.

APPENDIX 7 – KEY VEGETATION GROUPS (FOR SCORING FISH HABITAT)

SPECIES REPRESENTING KEY VEGETATION GROUPS

(based on Janecek 1988 as modified by Bill Crins, Regional Ecologist, MNR Central Region, June 1992).

GROUP 1 – TALLGRASS

Calamagrostis canadensis	Canada bluejoint	*Phalaris arundinacea*	reed canary grass
Eleocharis palustris	common spikerush	*Phragmites australis*	reedgrass
Glyceria grandis	tall mannagrass	*Spartina pectinata*	cordgrass
Glyceria maxima	giant mannagrass	*Zizania* all	wild rice
Leersia oryzoides	Cutgrass		

GROUP 2 - SHORTGRASS – SEDGE

Alopercurus aequalis	short-awn foxtail	*Juncus* most	rush
Beckmannia szyigachne	sloughgrass (N)	*Littorella americana*	littorella
Carex all	sedge	*Lobelia dortmanna*	water lobelia
Cladium mariscoides	nut-sedge	*Panicum all*	panic grass
Cyperus all	umbrella-sedge	*Rhynchospora* all	beak-rush
Dulichium arundinaceum	three-way sedge	*Scirpus americanus*	American bulrush
Elatine all	waterwort	*Scirpus cyperinus*	wool-grass
Eleocharis most (see group 1)	spikerush	*Scirpus hudsonianus*	northern club-rush
Eriocaulon septangulare	pipewort	*Scirpus rubrotinctus*	red-tinged bulrush
Eriophorum all	cotton-grass	*Scirpus smithii*	Smith's bulrush
Glyceria most (see group 1)	mannagrass	*Subularia aquatica*	awlwort (N)
Isoetes all	quillwort		

GROUP 3 - CATTAIL-BULRUSH

Acorus all	sweet flag	*Scirpus heterochaetus*	great bulrush
Butomus umbellatus	flowering rush	*Scirpus torreyi*	softstem bulrush
Equisetum all	horsetail	*Scirpus validus*	blackish bulrush
Hippuris vulgaris	mare's tail	*Sparganium americanum*	eastern bur-reed
Iris versicolor	blue flag	*Sparganium chlorocarpon*	greenfruit bur-reed
Scirpus acutus	hardstem bulrush	*Sparganium eurycarpum*	giant bur-reed
Scirpus fluviatilis	river bulrush	*Typha* all	cattail

GROUP 4 - ARROWHEAD-PICKERELWEED

Alisma plantago-aquatica	water-plantain	*Pontederia cordata*	pickerelweed
Calla palustris	water arum	*Sagittaria* all	arrowhead
Caltha all	marsh marigold	*Saururus cernuus*	lizard's tail (S)
Peltandra virginica	arrow-arum		

GROUP 5 - DUCKWEEDS

Lemna all	duckweed	*Spirodela polyrhiza*	big duckweed
Riccia all	liverwort	*Wolffia all*	watermeal
Ricciocarpus all	liverwort		

GROUP 6 - SMARTWEED - WATERWILLOW

Asclepias incarnata	swamp milkweed	*Penthorum sedoides*	ditch stonecrop
Decodon verticillatus	water willow	*Polygonum most* (see group 2)	smartweed
Gratiola aurea	hedge hyssop	*Potentilla palustris*	marsh cinquefoil
Lythrum salicaria	purple loosestrife	*Veronica scutellata*	marsh speedwell

GROUP 7 - WATERLILY - LOTUS

Brasenia schreberi	watershield	*Nymphaea all*	water-lily
Nelumbo lutea	lotus (S)	*Nymphoides cordata*	floating heart
Nuphar all	spatterdock	*Potamogeton natans*	common pondweed

GROUP 8 - WATERWEED - WATERCRESS

Elodea all	waterweed	*Nasturtium* all	water cress (S)

GROUP 9 – RIBBONGRASS

Alisma gramineum	narrow water-plantain	*Sparganium angustifolium*	narrow bur-reed
Heteranthera dubia	water star-grass	*Sparganium fluctuans*	floating bur-reed
Potamogeton zosteriformis	flatstem pondweed	*Sparganium natans*	least bur-reed
Scirpus subterminalis	water bulrush	*Vallisneria americana*	tape-grass

GROUP 10 - COONTAIL-NAIAD-WATERMILFOIL

Armoracia aquatica	lake cress	*Potamogeton pectinatus*	sago pondweed
Ceratophyllum all	coontail	*Potamogeton vaginatus*	sheathing pondweed
Megalodonta beckii	water marigold	*Proserpinaca palustris*	mermaid weed
Myriophyllum all	water-milfoil	*Ranunculus aquatilis*	white water-crowfoot
Najas most	naiad	*Ranunculus flabellaris*	yellow water-crowfoot
Podostemum ceratophyllum	riverweed	*Ranunculus trichophyllus*	hairyleaf water crowfoot
Potamogeton confervoides	alga pondweed (N)	*Utricularia all*	bladderwort
Potamogeton filiformis	fine leaved pondweed	*Zannichellia palustris*	hornwort

GROUP 11 - NARROW-LEAF PONDWEED

Callitriche all	water-starwort	*Potamogeton oakesianus*	Oake's' pondweed
Hippurus vulgaris	mare's-tail	*Potamogeton obtusifolius*	bluntleaf pondweed
Potamogeton epihydrus	ribbonleaf pondweed	*Potamogeton pusillus*	delicate pondweed
Potamogeton foliosus	leafy pondweed	*Potamogeton robbinsii*	Robbins' pondweed
Potamogeton friesii	Frie's pondweed	*Potamogeton spirillus*	curled pondweed
Potamogeton gramineus	variable pondweed	*Potamogeton strictifolius*	straightleaf pondweed
Potamogeton hillii	Hill's pondweed	*Potamogeton vaseyi*	Vasey's pondweed

GROUP 12 - BROAD-LEAF PONDWEEDS

Polygonum amphibium	water smartweed	*Potamogeton perfoliatus*	thornwort pondweed
Potamogeton alpinus	northern pondweed	*Potamogeton praelongus*	whitestem pondweed
Potamogeton amplifolius	largeleaf pondweed	*Potamogeton richardsonii*	clasping-leaf pondweed
Potamogeton crispus	curly leaf pondweed	*Ranunculus sceleratus*	cursed crowfoot
Potamogeton illinoensis	Illinois pondweed	*Ranunculus septentrionalis*	swamp buttercup
Potamogeton nodosus	longleaf pondweed		

(S) occurs in Southern Ontario only (N) occurs in Northern Ontario only

APPENDIX 8 – WETLAND SYSTEM KEY AND NODAL DESCRIPTIONS

NOTES:

i. Evaluator must observe flooding and water table above substrate surface at time of sampling.

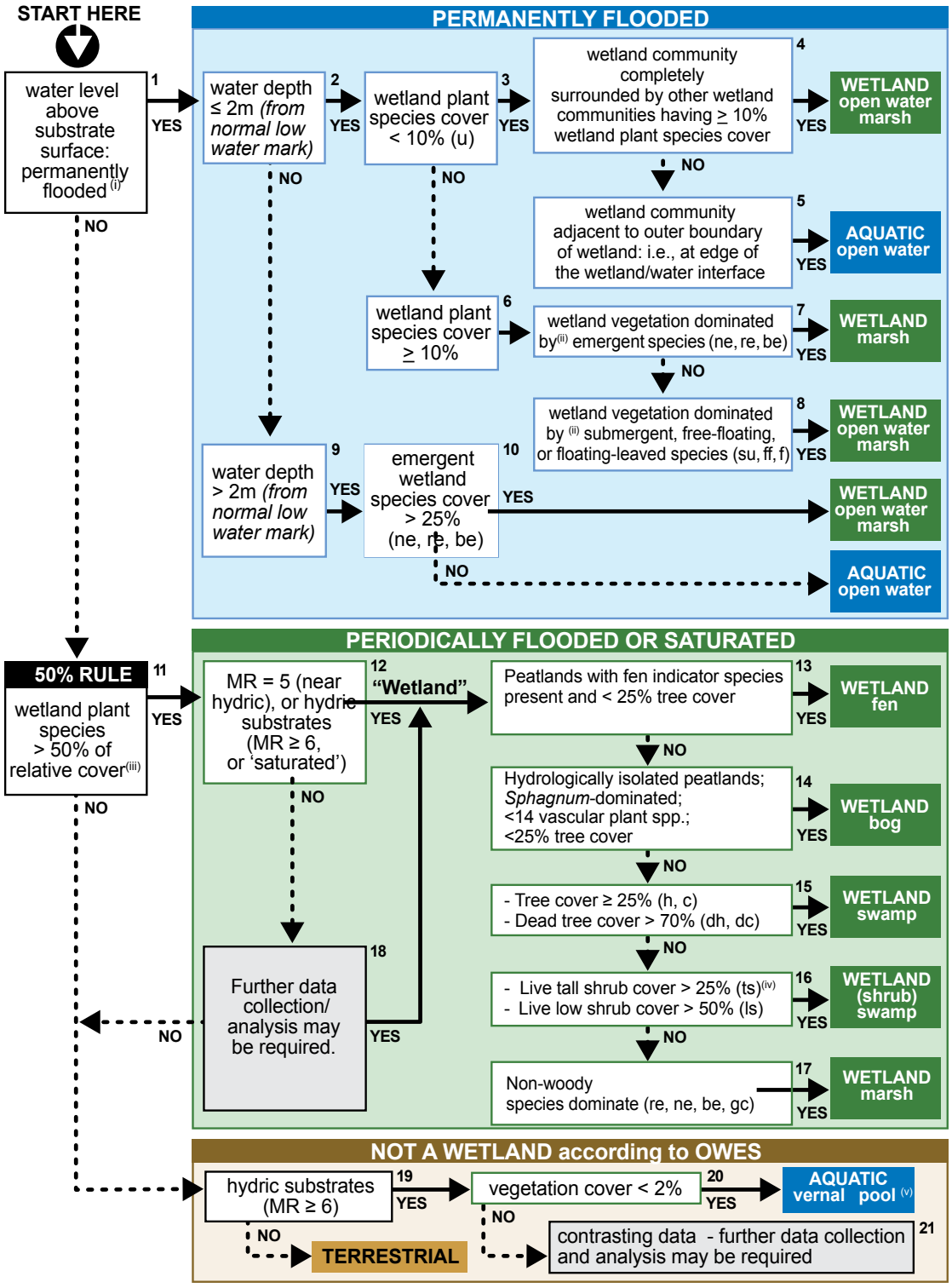
ii "Dominated by" refers to the prevalent OWES form(s) in a community.

iii Refer to Appendix 10.

iv For OWES purposes, bogs and fens may have more than 25% cover of **live tall shrubs**.

v Aquatic "vernal" pool is an ELC term. Some unvegetated vernal pools may meet the OWES definition of a wetland, e.g., an unvegetated pool completely surrounded by wetland vegetation.

Wetlands constructed for purposes other than wetland conservation (e.g., storm water management ponds, sewage lagoons, water treatment ponds) and in active use as such are **not** considered under OWES. Refer to nodal descriptions for further explanation and guidance.



Nodal Descriptions for the Wetland System Key

- **Node 1.** Distinguishes those sites where the water table is always above the substrate surface from those where the water table periodically or seasonally falls below and exposes the substrate surface. Permanent flooding is an ecological constraint, eliminating those plant species which require periods of water table draw-down and exposed substrates to germinate establish and grow. This node distinguishes the flooded shorelines of lakes, ponds, permanent pools, along with persistent rivers, and creeks. If flooding is not observed, at time of sampling (i.e. you observe bare substrates) then it is not considered to be permanently flooded. Similarly, if an area has long been characterized as being permanently flooded, yet is recently being observed with draw-down periods and exposed substrates, then the site should not be considered permanently flooded.

- **Node 2.** Distinguishes sites with water levels that are less than 2 m depth from sites that have water levels greater than 2 m depth. Submergent and floating-leaved species can often extend out into deeper water, yet the limitations of light, germination and establishment often make these deeper aquatic communities sparse.

- **Node 3.** Distinguishes sites which have little vegetation cover (< 10%), from those which are vegetated (≥ 10%). This is the contrast to Node 6. This assessment uses "absolute" cover, which means that wetland plant cover is less than 10%.

- **Node 4.** Captures areas within the outer boundary of the wetland or wetland complex that have little or no vegetation cover, yet are surrounded by vegetated wetlands areas. Distinguishes sparsely vegetated (or unvegetated) sites completely surrounded by more heavily vegetated areas from sparsely vegetated sites that are open to unvegetated deep water.

- **Node 5.** Sparsely vegetated sites (<10% vegetation cover) can not be mapped as wetland if they are open to unvegetated expanses of water – in these cases, the areas should be excluded from the wetland.

- **Node 6.** Distinguishes vegetated wetlands (≥ 10% absolute plant cover) from those which have little vegetation cover. This is in contrast to Node 3. This assessment uses "absolute" cover, which means that 10% or greater of the area has wetland plant cover.

- **Node 7.** Distinguishes emergent from submergent or floating-leaved vegetation. Emergent vegetation includes: narrow-leaved emergents (ne), robust emergents (re), and broad-leaved emergents (be). Dominated by" refers to the prevalent OWES form(s) in a community. The dominant vegetation form must be present in at least 25% of a vegetation community.

- **Node 8.** Distinguishes submergent or floating-leaved from emergent vegetation. Submergent or floating leaved includes: submerged (su), floating-leaved (f) and free floating (ff). Dominated by" refers to the prevalent OWES form(s) in a community. The dominant vegetation form must be present in at least 25% of a vegetation community.

- **Node 9.** Distinguishes sites with water levels that are greater than 2 m depth from sites that have water levels less than 2 m depth. This is the contrast to Node 2. For OWES purposes, water depth is measured relative to the normal low water mark.

- **Node 10.** In water deeper then 2 m, only sites that are dominated by emergent vegetation species (e.g., narrow-leaved emergents, broad-leaved emergents or robust emergents) are to be included as part of the wetland. Emergent species must cover at least 25% of the community and must be the dominant form. All other deep water areas are considered not to be "wetland".

- **Node 11.** The node reflects the "50% Rule", consistent with the OWES. The "50% rule" is meant to distinguish sites where the plant association is made up mostly of wetland species (refer to Appendix 10). This node assesses and compares the **relative** cover of wetland species to upland species. This node is **not** meant to compare the number of wetland species versus the number of upland species. The order in which the vegetation layers are assessed should reflect the structural nature of the vegetation, from the upper layers to the ground layers.

- The upper layers, especially the woody trees and shrubs, are typically longer-lived and therefore better reflect the long-term moisture on the site. Thus, in treed conditions, first assess whether the trees are wetland species, along with their relative cover;
- Similarly, in shrub-dominated areas, begin with assessing the upper shrub layers first, or follow upper tree layers when present;
- Once woody vegetations have been assessed, or where only herbaceous vegetation dominates, move to the herbaceous layers or ground layers; and
- When there are contradictory messages from different layers, use the dominant layer(s) as your best indicator.

- Node 12. Distinguishes sites which have **hydric substrates** from those which have terrestrial substrates. The ELC program for Ontario has developed the provincial substrate standards, and Substrate Types which can be used to identify hydric substrates. Substrates that have a moisture regime (MR) greater than 5 or which are **saturated** are considered **hydric** substrates. This node distinguishes hydric substrates (i.e., those that are "very moist", "wet" or "saturated") from other substrates (i.e., "dry", "fresh", or "moist"). Moist substrates (MR = 5) represent "near hydric conditions". MR 5 substrates can allow for the formation and persistence of wetland plants. Under the OWES, hydric (MR >5) and nearly hydric (MR = 5) substrates can be considered "hydric soils". Areas with substrates of MR = 5 may be either wetland or upland. To consider areas with MR = 5 as wetland, the "50% wetland vegetation rule" must be met.

  Some sites exhibiting hydric substrates may be dominated (i.e., 50% or more, relative cover) by upland plant species. In these cases, land uses changes or other disturbances that have occurred some time ago have changed the way the site functions; such changes are often regularly maintained (e.g., agricultural crops), but, since substrate characteristics can remain for many years following surface-level changes, hydric substrates may still appear. In such instances, the site should not be identified as wetland.

Wetland Class Keys Node 13 to 17 are meant to determine what class of wetland it is, by establishing linkage to ELC terms and conventions.

- Node 13. Fens are peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. Fen peats generally consist of mosses and sedges. *Sphagnum*, if present, is usually composed of different *Sphagnum* species than occur in bogs. There are two main fen types: nutrient-rich fens typically are fed by groundwater and have a high pH. Nutrient-poor fens, such as those in moraine-dominated landscapes, can occur in isolated depressions with less groundwater inputs and a lower pH (but not as low as in bogs). Nutrient-poor fens usually develop in situations of restricted drainage where oxygen saturation is relatively low and mineral supply is restricted. Usually very slow internal drainage occurs through seepage down very low gradient slopes, although sheet surface flow may occur during spring melt or periods of heavy precipitation or if a major local or regional aquifer discharges into the wetland. Rich fens can develop directly on limestone rock where minerotrophic waters are emerging through constant groundwater discharge.

  Fens have a higher diversity of plants compared to bogs which typically have less than 14 species of vascular plants. The presence of fen indicator species is a key to identifying this wetland type. For example, several moss species with narrow pH tolerances are common in fens and, if the evaluator is able to identify them, can be used as fen indicators. *Sphagnum* species may form a mat in poor fens, however they can be absent from rich fens. Fens can be dominated by sedges and grasses, especially in rich fens. Low shrubs, e.g., sweet gale (*Myrica gale*) or ericaceous species can occur with the latter particularly common as a low shrub layer in poor fens. Sometimes there is a tall shrub layer that can exceed 25% cover, and this often includes stunted tamarack (*Larix laricina*) and eastern white cedar (*Thuja occidentalis*). There can be a sparse layer of trees, often of tamarack or eastern white cedar and, in poor fens also black spruce (*Picea mariana*). **Live tree cover can't exceed 25%. If live tree cover is greater than 25% then the area must be identified as a swamp even if fen indicator species are present.**

- **Node 14.** Bogs are peat-covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly *Sphagnum*. The water table is at or near the surface in the spring, and slightly below during the remainder of the year. The mosses often form raised hummocks, separated by low, wet interstices. The bog surface is often raised, or, if flat or level with the surrounding wetlands, it is virtually isolated from mineral soil waters. Hence, the surface bog water and peat are strongly acidic and upper peat layers are extremely deficient in mineral nutrients. Peat is usually formed in situ under conditions of closed drainage and low oxygen levels.

  Bogs may be treed or treeless but the tree cover does not exceed 25% and consists largely of black spruce. Tamarack may be present but only in small numbers and usually only near the edge. For OWES purposes bogs may support more than 25% cover of live tall shrubs, typically stunted black spruce. Bogs are frequently characterized by a layer of ericaceous shrubs such as leatherleaf (*Chameadaphne calyculata*). Although bogs are usually covered with *Sphagnum*, they also can support sedges such as few-flowered sedge (*Carex oligosperma*) among others.

  The following criteria can assist evaluators in the identification of a bog. They are listed in order of importance. If all of the first 5 criteria are not met then it is not likely that the wetland is a bog:

  1. Raised peat hummocks are present.
  2. The wetland is ombrotrophic, i.e., dependent on atmospheric moisture for its nutrients.
  3. Low plant species diversity (usually less than 14 species of vascular plants).
  4. Few or no fen indicator plant species are present.
  5. Few or no tamarack or eastern white cedar are present.
  6. Low pH (often less than 4.7) [1]
  7. Tree cover does not exceed 25% [2]

- **Node 15.** If the site has greater than 25% cover of **trees** (using absolute cover), then the wetland is considered to be a swamp. For OWES purposes a tree is any woody vegetation greater than 6 m in height. Please note, that according to OWES, a wetland that has over 70% cover of dead standing trees is also considered a swamp.

- **Node 16.** In general any site with greater than 25% cover of live tall shrubs (absolute cover) is considered a thicket swamp. Note, however, that for OWES purposes, some bogs and fens may have more than 25% cover of **live tall shrubs**.

- **Node 17.** If the criteria in nodes 13 to 16 are not met then by default vegetation is dominated by non-woody species. Wetlands dominated by non-woody plant species are marshes.

- **Node 18.** Sometimes contrasting data pose challenges, specifically the 50% vegetation rule is met, but Moisture Regime is less than 5 (i.e., near hydric or hydric substrates are not present). Check to make sure that the substrate sampling is in a representative location, or describe more substrate samples to confirm prevailing conditions. Contrasting conditions should be resolved by collecting more data and describing the vegetation and substrates in more detail. However, if data discrepancies are resolved, then rely upon the "50% wetland vegetation rule". In other words,identify the area as "wetland", and proceed to node 13.

- **Node 19.** Just like Node 12, this node is meant to distinguish those sites which have **hydric substrates** from those which have terrestrial substrates. The ELC program for Ontario has developed the provincial substrate standards and Substrate Types which can be used to identify **hydric** substrates. Substrates that have a moisture regime greater than or equal to 6 or which are **saturated** are considered hydric substrates. If hydric substrates are present then proceed to Node 20. If hydric substrates are not present then the site is considered to be upland terrestrial.

- **Node 20.** This node is meant to distinguish a unique situation that is captured by the ELC. When an area is isolated, naturally devoid of vegetation cover and has hydric substrates, then it is considered a "vernal pool" according to the ELC. Some unvegetated vernal pools may meet the OWES definition of a wetland, e.g., an unvegetated pool completely surrounded by wetland vegetation.

1. See Harris *et al*. (1996) and Riley (1994). In a wetland evaluation context measurements of pH may help corroborate identification of wetland type, but they are not mandatory.
2. For OWES purposes wetlands with tree cover (> 6 m tall) equal to or greater than 25% (absolute) cover are defined as swamps.

- Node 21. Resolution of contradictory information: 50% relative cover rule not met but hydric substrates present. In these cases further data collection and analysis is required. If the substrates are clearly hydric, then a re-evaluation of the vegetation data can be done. This serves as a double check to make sure that the best call was made for the 50% rule.

  Some sites having hydric substrates may be dominated (e.g., 50% or more relative cover) by upland plant species. In these cases, land uses changes or other disturbances that have occurred some time ago have changed the way the site functions. Such changes are often regularly maintained (e.g., agricultural crops), but since substrate characteristics can remain for many years following surface-level changes, colours indicating hydric substrates may still appear. In such instances, the site should not be identified as wetland. For the purposes of confirming wetlands or not and for planning applications and application of OWES, the 50% rule "trumps" substrate information, when contrasting data exist.

APPENDIX 9 – SUBSTRATE CHARACTERISTICS

	Substrate		Feel Test	Moist Cast	Ribbon Test Test	Taste Test	Shine Test	Texture 'Class'
Mineral	Sand	S	Grainy with little floury material	No cast	None	unnecessary	unnecessary	Sandy
	Loamy Sand	LS	Grainy with slight amount of floury material	Very weak, cast no handling	None	unnecessary	unnecessary	Sandy
	Silty Sand	SiS	Grainy with moderate amount of floury material	Weak cast, no handling	Almost flakes if sand portion is vfS fS	unnecessary	unnecessary	Sandy
	Sandy Loam	SL	Grainy with moderate amount of floury material	Weak cast, allow careful handling	Barely ribbons (1.5-2.5 cm)	unnecessary	unnecessary	Coarse Loamy
	Loam	L	Fairly soft and smooth with evident graininess	Good cast, readily handled	Thick and very short (< 2.5 cm)	unnecessary	unnecessary	Coarse Loamy
	Silt Loam	SiL	Floury with slight graininess	Weak cast, allows careful handling	Flakes, rather than ribbons	Silt grittiness, some sand graininess	unnecessary	Silty
	Silt	Si	Very floury	Weak cast, allows careful handling	Flakes, rather than ribbons	Silt grittiness	unnecessary	Silty
	Sandy Clay Loam	SCL	Very substantial graininess	Moderate cast	Short and thick (2.5-5 cm)	Sand graininess clearly evident	Slightly shiny	Fine Loamy
	Clay Loam	CL	Moderate	Strong cast graininess	Fairly thin, breaks readily, barely supports own weight	Sand graininess clearly evident	Slightly shiny	Fine Loamy
	Silty Clay Loam	SiCL	Smooth and floury	Strong cast	Fairly thin, breaks readily, barely supports own weight	Silt grittiness	Slightly shiny	Fine Loamy
	Sandy Clay	SC	Substantial graininess	Strong cast	Thin, fairly long (5-7.5 cm) holds own weight	Sand graininess clearly evident	Moderately shiny	Fine Loamy
	Silty Clay	SiC	smooth	Very strong cast	Thin, fairly long (5-7.5 cm) holds own weight	Silt grittiness	Moderately shiny	Clayey
	Clay	C	smooth	Very strong cast	Very thin, very long (> 7.5 cm)	Smooth	Very shiny	Clayey

Descriptors of Organic Substrates: Terms used to describe organic materials, codes and descriptions.
Source: OMNR Southern Region ELC.

Modifier	Name	Descriptions
L	litter	■ non-decomposed leaf litter on top of substrate
F	fermented or fibric	■ plant material indistinct, yet some fibrous nature of the organics remains
H	humic or humus	■ dark and greasy, very little fibric material
Hi	organo-mineral	■ a horizon characterized by an accumulation of spherical or cylindrical organic granules with considerable intermixing with mineral particles ■ an intermediate stage between an H and an Ah horizon
Of	Fibric Peat	■ the least decomposed organic peat developed mainly from *sphagnum* or graminoids. ■ contains large amounts of well-preserved fiber by volume (> 40% rubbed fibre by volume) ■ von Post scale of decomposition 1 to 4
Om	Mesic Peat	■ intermediate stage of decomposed organic peat developed mainly from *sphagnum* or graminoids. ■ contains minimum amounts of well-preserved fiber by volume (10 – 40% rubbed fibre by volume) ■ von Post scale of decomposition 5 and 6
Oh	Humic Peat	■ the most decomposed organic peat developed mainly from *sphagnum* or graminoids. ■ contains small amounts of well-preserved fiber by volume (< 10% rubbed fibre by volume) ■ von Post scale of decomposition 7 to 10

Descriptors of Folic (Humus) Materials

Modifier	Name	Descriptions
He	Hemic	Folic material dominated by a moderately decomposed F horizon consisting of partly decomposed folic material generally derived from leaves, needles, twigs, and woody materials, with or without a minor component of mosses, containing numerous live and dead roots. H and "O" horizons must be less than 10 cm thick.
Hu	Humic	Folic material dominated by well decomposed H horizons derived of well decomposed folic material generally derived from leaves, needles, twigs, and woody materials, with or without a minor component of mosses, containing numerous live and dead roots. May have subdominant F and "O" horizons each < 10 cm thick.
Li	Lignic	Folic material dominated by F or H, which are composed of moderately to well decomposed woody material (occupying > 30% by area of the excavated face. The source of woody material is generally trees that have been blown down in either periodic or continual processes.
Hi	Histic	Folic material dominated by F or H horizons that are underlain by a significant (> 10 cm) "O" horizon. Originally peaty substrates where accumulation became deep enough to produce surface conditions suitable for forest development and the encroachment of Folisol development.

APPENDIX 10 – WETLAND PLANT LIST

This wetland plant list is intended to support the delineation of wetland boundaries using the Ontario Wetland Evaluation System.

In this evaluation system wetlands are defined as:

> *"Lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants".*

This definition, and the list of wetland plant species below, includes those species that occur primarily in wetlands (identified as "wetland indicators") as well as those "water tolerant" plant species that can occur in both wetlands and uplands. The intent of the "50% wetland vegetation" rule is to judge where plant species cover consists mostly (>50%) of wetland plants. This rule uses relative cover, and assesses the relative abundance of wetland plant species to upland plant species cover. It is very important to note that the 50% rule is not based on the number of species, but on the relative cover of species.

All plant species, native and introduced and in all vegetation community layers must be taken into consideration. Where tree and/or shrub forms are present the evaluator should first look at these woody vegetation layers to determine if the site is dominated by wetland indicators. These woody vegetation forms are the best indicators of long term site conditions. However, some species that can dominate or co-dominate in wetlands may also occur in upland habitats. Where these woody vegetation species do not clearly indicate upland or wetland other vegetation layers (forms) should be used to assist in the determination of wetland or upland conditions. The presence and relative cover of wetland indicators can also help. If an examination of all layers of vegetation does not determine whether the 50% rule has been met, substrates can be used to help determine whether the area is wetland or upland.
When there are contradictory messages from different vegetation layers, use the dominant layers as your primary indicator. In situations where there is a discrepancy between the vegetation and substrate indicators, rely upon the "50% wetland vegetation rule".

This Wetland Plant List may be updated from time to time and any such updates will be made available on a website.

DEFINITIONS

Wetland plant species: species that are found in wetlands in Ontario. "Wetland plant species" range from those species that occur primarily in wetlands ("wetland indicators") to those species that occur in both wetlands and uplands.

Wetland indicator species: species mostly confined to wetlands within Ontario (noted with a Y). If a species is only an indicator in one part of the province that will be indicated in parentheses.

Wetland Type codes: M = Marsh; W = Open water marsh; S = Swamp; F= Fen; B = Bog.

OWES Area: notes whether a species occurs in the area of the OWES southern manual which covers ecoregions 6 and 7 (South), in the area of the OWES northern manual which covers ecoregions 2, 3, 4 and 5 (North), or in both (All).

Non-native species: species that are introduced to the province (noted with a Y).

Dominant/Co-dominant Species: Species that can dominate or co-dominate a form, i.e. covering 25 % or more of the total cover of the form (noted with a Y).

Vascular Plants

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Abies balsamea		Balsam Fir		S	All		Y
Acer negundo		Manitoba Maple; Box Elder		S	All	Y	Y
Acer rubrum		Red Maple		M, S	All		Y
Acer saccharinum		Silver Maple	Y	S	All		Y
Acer spicatum		Mountain Maple		S	All		Y
Acer X freemanii	*A. rubrum X A. saccharinum*	Hybrid Maple; Freeman's Maple	Y	S	All		Y
Acorus americanus		Sweetflag	Y	M	All		Y
Acorus calamus		Sweetflag	Y	M	South	Y	
Agalinis paupercula	*Gerardia purpurea* var. *paupercula*	Small-flowered Agalinis	Y	M, F	All		
Agalinis purpurea	*Gerardia purpurea*	Large Purple Agalinis; Purple False Foxglove		M	South		
Agalinis tenuifolia	*Gerardia tenuifolia* var. *tenuifolia*	Slender Agalinis		M, S	All		
Ageratina altissima	*Eupatorium rugosum*	White Snakeroot		M, S	South		
Agrostis scabra		Rough Bentgrass; Fly-away Grass; Tickle Grass		M	All		
Agrostis stolonifera		Spreading Bentgrass; Creeping Bentgrass		M, S	All	Y	Y
Alisma gramineum		Narrow-leaved Water-plantain; Geyer's Water-Plantain	Y	M, W	All		Y
Alisma subcordatum		Small-flowered Waterplantain	Y	M	South		Y
Alisma triviale	*A. plantago-aquatica; A. subcordatum*	Northern Water-plantain; Common Water-plantain	Y	M, S	All		Y
Alnus glutinosa		European Alder; Black Alder		S	South	Y	Y
Alnus incana	*A. rugosa*	Speckled Alder	Y	M, S, F	All		Y
Alopecurus aequalis		Short-awn Foxtail; Water Foxtail	Y	M, S	All		Y
Alopecurus geniculatus		Geniculate Foxtail		M	South	Y	
Althaea officinalis		Common Marsh Mallow		M	South	Y	
Amaranthus tuberculatus	*Acnida altissima*	Rough-fruit Amaranth	Y	M, S	South		
Amerorchis rotundifolia		Round-leaved Orchis	Y	S, F	All		
Ammannia robusta	*A. coccinea*	Scarlet Ammannia; Robust Ammannia	Y	M	South		
Amphicarpaea bracteata		American Hog-peanut		S	All		
Andromeda polifolia ssp. *glaucophylla*	*A. glaucophylla*	Bog Rosemary	Y	F	All		Y
Andromeda polifolia ssp. *polifolia*		Dwarf Bog Rosemary	Y	B	North		
Anemone candensis		Canada Anemone		S	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Angelica atropurpurea		Great Angelica	Y	M, S	South		
Apios americana		American Groundnut		M, S	All		
Arceuthobium pusillum		Dwarf Mistletoe		S, F, B	All		
Arethusa bulbosa		Swamp-pink; Arethusa	Y	F	All		
Argentina anserina	*Potentilla anserina*	Silverweed		M, F	All		Y
Arisaema dracontium		Green Dragon	Y	S	South		
Arisaema triphyllum		Jack-in-the-Pulpit		S	All		
Arnoglossum plantagineum	*Cacalia plantaginea; C. tuberosa*	Tuberous Indian-plantain	Y	F	South		
Asclepias incarnata		Swamp Milkweed	Y	M, S, F	All		Y
Athyrium filix-femina		Lady Fern		S	All		
Azolla caroliniana		Eastern Mosquito-fern; Carolina Azolla	Y	M, W	South		
Barbarea orthoceras		American Winter-cress; Northern Winter-cress; American Yellowrocket	Y	M	North		
Bartonia paniculata		Branched Bartonia; Twining Bartonia	Y	F	North		
Bartonia virginica		Yellow Bartonia	Y	F	All		
Beckmannia syzigachne		American Slough Grass	Y	M	All		Y
Betula alleghaniensis	*B. lutea*	Yellow Birch		S	All		Y
Betula occidentalis		River Birch		S	North		
Betula papyrifera		Paper Birch; White Birch		S	All		Y
Betula pendula		European White Birch		S, B	South	Y	Y
Betula populifolia		Gray Birch		S	South		Y
Betula pumila		Swamp Birch	Y	S, F	All		Y
Bidens cernua	*B. cernuus*	Nodding Beggar-ticks	Y	M, S	All		Y
Bidens discoidea	*B. discoideus*	Swamp Beggar-ticks; Small Beggar-ticks	Y	M, S	South		
Bidens frondosa	*B. frondosus*	Devil's Beggar-ticks	Y	M, S	All		Y
Bidens hyperborea		Coastal Beggar-ticks; Estuary Beggar-ticks	Y	M	North		
Bidens trichosperma	*B. coronata; B. coronatus*	Crowned Beggar-ticks	Y	M	South		
Bidens tripartita	*B. comosa; B. comosus; B. connata; B. connatus*	Three-parted Beggar-ticks	Y	M, S	All		Y
Bidens vulgata	*B. vulgatus*	Tall Bur-marigold; Tall Beggar-ticks		M	All		Y
Bistorta vivipara	*Polygonum viviparum*	Viviparous Knotweed; Alpine Bistort		M	North		
Boehmeria cylindrica		False Nettle	Y	M, S	All		Y
Brachyelytrum erectum		Bearded Short-husk		S	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Brasenia schreberi	*B. peltata*	Watershield	Y	M, W	All		Y
Bromus ciliatus		Fringed Brome		M, S	All		
Bromus latiglumis		Broad-glumed Brome		S	South		
Buchnera americana		Bluehearts	Y	M	South		
Butomus umbellatus		Flowering-rush	Y	M	All	Y	
Cabomba caroliniana		Carolina Fanwort	Y	M, W	South	Y	
Calamagrostis canadensis		Canada Blue-joint	Y	M, S	All		Y
Calamagrostis stricta ssp. *inexpansa*	*C. inexpansa; C. lacustris*	Narrow-spike Small- reedgrass	Y (South)	M, F	All		Y
Calamagrostis stricta ssp. *stricta*	*C. stricta*	Northern Reed Grass	Y (South)	M, F	All		Y
Calamintha arkansana	*Satureja arkansana*	Low Calamint		M, F	South		
Calla palustris		Wild Calla; Water Arum	Y	M, S, F	All		
Callitriche hermaphroditica		Autumnal Water-starwort	Y	M	All		
Callitriche heterophylla		Large Water-starwort	Y	M	North		
Callitriche palustris	*C. verna*	Vernal Water Starwort	Y	M	All		
Calopogon tuberosus	*C. pulchellus*	Tuberous Grass-pink	Y	F	All		
Caltha natans		Floating Marsh Marigold	Y	M	North		
Caltha palustris		Marsh Marigold	Y	M, S	All		Y
Campanula aparinoides		Marsh Bellflower	Y	M, F	All		
Canadanthus modestus	*Aster modestus*	Canada Aster; Western Bog Aster; Great Northern Aster	Y	F	North		
Cardamine bulbosa		Bulbous Bitter-cress	Y	S	South		
Cardamine douglassii		Purple Cress		S	South		
Cardamine pensylvanica		Pennsylvania Bitter-cress	Y	M, S	All		
Cardamine pratensis		Cuckoo-flower	Y	S, F	All		
Carex acutiformis		Swamp Sedge; European Lake Sedge	Y	M	South	Y	Y
Carex alata		Broad-winged Sedge	Y	S	South		
Carex albicans var. *emmonsii*	*C. emmonsii*	Emmons' White-tinged Sedge		S	South		
Carex alopecoidea		Foxtail Sedge		M	All		
Carex aquatilis		Water Sedge	Y	M, F	All		
Carex arcta		Northern Clustered Sedge; Bear Sedge	Y	M, S	North		
Carex atherodes		Awned Sedge	Y	M	All		Y
Carex atlantica		Atlantic Sedge	Y	M, F	South		
Carex aurea		Golden-fruited Sedge		M, F	All		
Carex bebbii		Bebb's Sedge	Y	M, S	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Carex billingsii	*C. trisperma* var. *billingsii*	Billing's Three-seeded Bog Sedge	Y	F, B	All		Y
Carex bromoides		Brome-like Sedge	Y	S	All		Y
Carex brunnescens		Brownish Sedge	Y	M, S, F	All		
Carex buxbaumii		Buxbaum's Sedge; Dark-scaled Sedge		F	All		Y
Carex canescens		Hoary Sedge	Y	M, S, F	All		
Carex capillaris		Hair-like Sedge		M, S	All		
Carex castanea		Chestnut-coloured Sedge		S	All		
Carex chordorrhiza		Creeping Sedge	Y	F	All		Y
Carex comosa		Bristly Sedge	Y	M	All		Y
Carex crawei		Crawe's Sedge		M	All		
Carex crawfordii		Crawford Sedge		M	All		
Carex crinita		Fringed Sedge	Y	M, S	All		Y
Carex cristatella		Crested Sedge	Y	M, S	South		
Carex crus-corvi		Crow-spur Sedge	Y	S	South		
Carex cryptolepis		Northeastern Sedge	Y	M, F	All		Y
Carex diandra		Lesser Panicled Sedge	Y	M, S, F	All		
Carex disperma		Softleaf Sedge	Y	S	All		Y
Carex echinata		Little Prickly Sedge	Y	M, S, F	All		
Carex emoryi		Riverbank Sedge; Emory's Sedge	Y	M	All		Y
Carex exilis		Coast Sedge	Y	F, B	All		
Carex flava		Yellow Sedge	Y	M, F	All		Y
Carex folliculata		Northern Long Sedge; Follicle Sedge	Y	M	All		
Carex frankii		Frank's Sedge	Y	S	South		
Carex garberi		Elk Sedge	Y	M	All		
Carex gracillima		Graceful Sedge		S	All		Y
Carex granularis		Meadow Sedge		M	All		Y
Carex grayi	*C. asa-grayi*	Asa Gray Sedge; Gray's Sedge	Y	S	South		Y
Carex gynandra		Nodding Sedge	Y	M, S	All		
Carex gynocrates		Northern Bog Sedge	Y	S, F	All		
Carex haydenii		Long-scaled Tussock Sedge	Y	M	All		
Carex hyalinolepis		Shore-line Sedge	Y	M, S	South		Y
Carex hystericina		Porcupine Sedge	Y	M	All		Y
Carex interior		Inland Sedge	Y	M, S, F	All		Y
Carex intumescens		Bladder Sedge	Y	M, S	All		Y
Carex lacustris		Lake-bank Sedge	Y	M, S	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Carex laeviconicia		Smooth Cone Sedge	Y	M, S	North		Y
Carex laevivaginata		Smooth-sheath Sedge	Y	M, S	South		
Carex lasiocarpa		Slender Sedge	Y	M, F, B	All		Y
Carex lenticularis		Shore Sedge	Y	M	All		
Carex leptalea		Bristly-stalk Sedge	Y	S, F	All		Y
Carex limosa		Mud Sedge	Y	F	All		Y
Carex livida		Livid Sedge	Y	F	All		
Carex loliacea		Ryegrass Sedge	Y	S	North		
Carex lupuliformis		False Hop Sedge	Y	S	South		
Carex lupulina		Hop Sedge	Y	M, S	All		
Carex lurida		Sallow Sedge		M, S	All		Y
Carex magellanica	*C. paupercula*	Boreal Bog Sedge	Y	S, F, B	All		Y
Carex michauxiana		Michaux Sedge	Y	M	North		
Carex molesta		Troublesome Sedge		M	All		
Carex muskingumensis		Muskingum Sedge	Y	S	South		
Carex normalis		Larger Straw Sedge		M, S	South		
Carex oligosperma		Few-seeded Sedge	Y	F, B	All		Y
Carex pallescens		Pale Sedge		S	All		
Carex pauciflora		Few-flowered Sedge	Y	F, B	All		
Carex pellita	*C. lanuginosa*	Woolly Sedge	Y	M, F	All		Y
Carex prairea		Prairie Sedge	Y	M, S, F	South		
Carex prasina		Drooping Sedge	Y	S	South		Y
Carex projecta		Necklace Sedge	Y	M, S	All		Y
Carex pseudocyperus		Cypress-like Sedge	Y	M, S	All		Y
Carex radiata		Stellate Sedge		S	All		Y
Carex retrorsa		Retrorse Sedge	Y	M, S	All		Y
Carex rostrata		Beaked Sedge	Y	M, F	North		Y
Carex sartwellii		Sartwell's Sedge	Y	M	All		Y
Carex scabrata		Rough Sedge	Y	M, S	All		Y
Carex schweinitzii		Schweinitz's Sedge	Y	M, S	South		Y
Carex scirpoidea		Single-spike Sedge		M, F	All		
Carex scoparia		Pointed Broom Sedge		M	All		
Carex seorsa		Weak Stellate Sedge	Y	S	South		
Carex squarrosa		Squarrose Sedge	Y	S	South		
Carex sterilis		Dioecious Sedge	Y	F	All		
Carex stipata		Stalk-grain Sedge; Awl-fruited Sedge	Y	M, S	All		
Carex stricta		Tussock Sedge	Y	M	All		Y
Carex suberecta		Prairie Straw Sedge	Y	M	South		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Carex sychnocephala		Many-headed Sedge; Dense Long-beaked Sedge	Y	M	All		
Carex tenera		Slender Sedge		M, S	All		
Carex tenuiflora		Sparse-flowered Sedge	Y	F	All		
Carex tetanica		Rigid Sedge	Y	M	All		
Carex tribuloides		Blunt Broom Sedge	Y	M, S	All		
Carex trichocarpa		Hairy-fruited Sedge	Y	M, S	South		Y
Carex trisperma		Three-seeded Sedge	Y	S, F, B	All		Y
Carex tuckermanii		Tuckerman Sedge	Y	M, S	All		Y
Carex typhina		Cattail Sedge	Y	S	South		
Carex utriculata		Beaked Sedge	Y	M, F	All		Y
Carex vaginata		Sheathed Sedge	Y	M	All		
Carex vesicaria		Inflated Sedge	Y	M, S	All		
Carex viridula		Little Green Sedge	Y	M, F	All		
Carex vulpinoidea		Fox Sedge	Y	M, S	All		Y
Carex wiegandii		Wiegand's Sedge	Y	F	North		
Carpinus caroliniana		Blue-beech; Hornbeam		S	South		
Carya laciniosa		Shellbark Hickory	Y	S	South		
Carya ovata		Shagbark Hickory		S	South		Y
Cephalanthus occidentalis		Common Buttonbush; Eastern Buttonbush	Y	M, S	All		Y
Ceratophyllum demersum		Common Hornwort; Common Coontail	Y	M, W	All		Y
Ceratophyllum echinatum		Prickly Hornwort; Prickly Coontail	Y	M, W	All		
Chamaedaphne calyculata		Leatherleaf	Y	M, S, F, B	All		Y
Chelone glabra		White Turtlehead	Y	M, S	All		
Chenopodium rubrum		Coast-blite Goosefoot; Red Goosefoot		M	South	Y	
Chenopodium salinum	*C. glaucum* var. *salinum*	Oak-leaved Goosefoot		M	All	Y	
Chrysosplenium americanum		American Golden Saxifrage	Y	S	All		
Cicuta bulbifera		Bulb-bearing Water-hemlock	Y	M, S	All		
Cicuta mackenziana	*C. virosa*	Mackenzie Water-hemlock	Y	M	North		
Cicuta maculata		Spotted Water-hemlock	Y	M, S	All		
Cinna arundinacea		Stout Wood Reedgrass		S	South		Y
Cinna latifolia		Slender Wood Reedgrass		S	All		
Circaea alpina		Small Enchanter's Nightshade	Y (South)	S	All		
Cirsium muticum		Swamp Thistle	Y	M, S, F	All		
Cirsium palustre		Marsh Thistle		M	North	Y	

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Cladium mariscoides		Twig-rush	Y	M, F	All		Y
Claytonia virginica		Narrow-leaved Spring Beauty		S	All		
Clematis virginiana		Virginia Virgin's-bower		M, S	All		
Clintonia borealis		Blue Bead-lily		S	All		
Collinsonia canadensis		Canada Horse-balm		S	South		
Comarum palustre	*Potentilla palustris*	Marsh Cinquefoil	Y	M, F	All		
Conioselinum chinense		Chinese Hemlock Parsley	Y	S	All		
Coptis trifolia	*C. groenlandica*	Goldthread	Y (South)	S	All		
Corallorhiza trifida		Early Coralroot; Yellow Coralroot		S	All		
Cornus amomum ssp. *obliqua*	*C. obliqua*	Silky Dogwood	Y	S	All		Y
Cornus racemosa	*C. foemina* ssp. *racemosa*; *Swida racemosa*	Gray Dogwood; Stiff Dogwood; Red Panicled Dogwood		S	All		Y
Cornus sericea	*C. stolonifera*	Red-osier Dogwood	Y (South)	M, S	All		Y
Crassula aquatica		Water Pigmyweed	Y	M	North		
Crataegus mollis		Downy Hawthorn		S	South		
Cuscuta cephalanthi		Buttonbush Dodder	Y	S	South		
Cuscuta gronovii		Gronovius Dodder		M	All		
Cyperus bipartitus	*C. rivularis*	River Flatsedge; River Umbrella-sedge	Y	M	All		
Cyperus dentatus		Toothed Flatsedge; Toothed Umbrella-sedge	Y	M	All		
Cyperus diandrus		Umbrella Flatsedge; Low Umbrella-sedge	Y	M	South		
Cyperus erythrorhizos		Red-rooted Nut Sedge; Red-rooted Umbrella-sedge	Y	M	South		
Cyperus esculentus		Chufa Flatsedge; Yellow Umbrella-sedge		M	All		
Cyperus flavescens		Annual Yellow Flatsedge; Yellowish Umbrella Sedge	Y	M	South		
Cyperus fuscus		Brown Flatsedge; Brown Umbrella-sedge	Y	M	South	Y	
Cyperus odoratus	*C. engelmannii*; *C.ferruginescens*	Rusty Flatsedge; Fragrant Umbrella-sedge	Y	M	South		
Cyperus squarrosus	*C aristatus*	Awned Cyperus; Squarrose Umbrella-sedge		M	All		
Cyperus strigosus		Straw-colored Flatsedge; Straw-coloured Umbrella-sedge		M, S	All		
Cypripedium acaule		Pink Moccasin Flower; Pink Lady's-slipper; Stemless Lady's-slipper		S, F	All		
Cypripedium candidum		Small White Lady's-slipper	Y	M, S, F	South		
Cypripedium parviflorum var. *makasin*	*C. calceolus* var. *parviflorum*	Small Yellow Lady's-slipper		M, S	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Cypripedium reginae		Showy Lady's-slipper	Y	S	All		
Cystopteris bulbifera		Bulblet Fern		S	All		Y
Dalibarda repens		Robin Runaway; Dewdrop		S	All		
Dasiphora fruticosa	*Potentilla fruticosa*	Shrubby Cinquefoil		F	All		Y
Decodon verticillatus		Hairy Swamp Loosestrife; Water-willow; Whorled Loosestrife	Y	M, S, F	All		Y
Deparia acrostichoides	*Athyrium thelypterioides*	Silvery Spleenwort		S	All		
Deschampsia caespitosa		Tufted Hairgrass		M, F	All		
Diarrhena obovata	*D. americana*	Ovate Beak Grass		S	South		
Dichanthelium implicatum	*Panicum acuminatum; P. implicatum; P. lanuginosum*	Acuminate Panic Grass		M	All		Y
Dichanthelium lindheimeri	*Panicum acuminatum* var. *lindheimeri; P. lindheimeri; P. lanuginosum* var. *lindheimeri*	Lindheimer's Panic Grass	Y	M	All		Y
Dichanthelium spretum	*Panicum spretum*	Eaton's Panic Grass	Y	M	North		Y
Diplazium pycnocarpon	*Athyrium pycnocarpon*	Glade Fern		S	South		
Doellingeria umbellata	*Aster umbellatus*	Flat-top White Aster		M, S	All		
Drosera anglica		Oblong-leaved Sundew; English Sundew	Y	F	All		
Drosera intermedia		Spoon-leaved Sundew	Y	M, F	All		
Drosera linearis		Linear-leaved Sundew; Slenderleaf Sundew	Y	F	All		
Drosera rotundifolia		Roundleaf Sundew	Y	M, F, B	All		
Dryopteris carthusiana	*D. spinulosa*	Spinulose Shield Fern; Spinulose Wood Fern		S	All		
Dryopteris clintoniana		Clinton's Wood Fern; Clinton's Shield Fern	Y	S	South		
Dryopteris cristata		Crested Wood Fern; Crested Shield Fern	Y	S	All		
Dulichium arundinaceum		Three-way Sedge	Y	M, S, F	All		Y
Echinochloa crus-galli		Common Barnyard Grass		M	All	Y	
Echinochloa muricata var. *microstachya*	*E. microstachya*	Small-spiked Barnyard Grass; Rough Barnyard Grass		M	All		
Echinochloa muricata var. *muricata*		Rough Barnyard Grass	Y	M	All		
Echinochloa walteri		Coast Barnyard Grass; Walter's Barnyard Grass	Y	M	South		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Echinocystis lobata		Wild Mock-cucumber		M, S	All		
Eclipta prostrata	*E. alba*	False-daisy	Y	M	South		
Elatine minima		Small Water-wort	Y	M	North		
Elatine triandra	*E. americana*	Long-stemmed Water-wort	Y	M	All		
Eleocharis acicularis		Least Spike-rush; Needle Spike-rush	Y	M	All		
Eleocharis compressa	*E. elliptica* var. *compressa*	Flat-stemmed Spike-rush		M, F	All		
Eleocharis elliptica	*E. tenuis* var. *borealis*	Slender Spike-rush: Elliptic Spike-rush	Y	M, F	All		
Eleocharis equisetoides		Horsetail Spike-rush	Y	M	South		
Eleocharis erythropoda		Bald Spike-rush; Red-footed Spike-rush	Y	M	All		Y
Eleocharis geniculata	*E. caribaea*	Bent Spike-rush	Y	M	South		Y
Eleocharis intermedia		Matted Spike-rush	Y	M	All		Y
Eleocharis nitida		Slender Spike-rush	Y	M	All		
Eleocharis obtusa	*E. obtusa* var. *obtusa*	Blunt Spike-rush	Y	M	All		Y
Eleocharis olivacea	*E. flavescens* var. *olivacea*	Capitate Spike-rush; Bright-green Spike-rush	Y	M	All		Y
Eleocharis ovata	*E. obtusa* var. *ovata*	Ovate Spike-rush; Ovoid Spike-rush	Y	M	All		Y
Eleocharis pauciflora	*E. quinqueflora*	Fewflower Spike-rush	Y	M, F	All		Y
Eleocharis quadrangulata		Square-stemmed Spike-rush; Four-angled Spike-rush	Y	M	South		Y
Eleocharis robbinsii		Robbins Spike-rush	Y	M	All		Y
Eleocharis rostellata		Beaked Spike-rush	Y	M, F	South		Y
Eleocharis smallii	*E. palustris*	Creeping Spike-rush; Small's Spike-rush	Y	M	All		Y
Elodea canadensis		Broad Waterweed; Canada Waterweed	Y	M, W	All		Y
Elodea nuttallii		Nuttall's Waterweed	Y	M, W	All		Y
Elymus virginicus var. *virginicus*		Virginia Wild Rye		M, S	All		
Epilobium ciliatum		Hairy Willow-herb	Y (South)	M, S	All		Y
Epilobium coloratum		Purple-leaf Willow-herb	Y	M, S	All		
Epilobium davuricum		Dahurian Willow-herb; Arctic Willow-herb	Y	M, S	North		
Epilobium hirsutum		Great Hairy Willow-herb	Y	M, S	South	Y	Y
Epilobium leptophyllum		Linear-leaved Willow-herb	Y	M, F	All		
Epilobium palustre		Marsh Willow-herb	Y	M, S	All		
Epilobium parviflorum		Sparse-flower Willow-herb		M, S	South	Y	Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Epilobium strictum		Downy Willow-herb	Y	M, S, F	All		
Equisetum arvense		Field Horsetail; Common Horsetail		M, S	All		
Equisetum fluviatile		Water Horsetail	Y	M, F	All		Y
Equisetum hyemale		Rough Horsetail; Scouring-rush		S	All		
Equisetum palustre		Marsh Horsetail	Y	M, S	All		
Equisetum scirpoides		Dwarf Scouring-rush		S	All		
Equisetum sylvaticum		Woodland Horsetail		S	All		Y
Equisetum variegatum		Variegated Horsetail	Y	M, F	All		Y
Equisetum X nelsonii	*E. laevigatum X E. variegatum*	Nelson's Horsetail		M	All		Y
Eragrostis frankii		Frank's Love Grass		M	All		
Eragrostis hypnoides		Teal Love Grass; Tall Love-grass	Y	M	All		
Erechtites hieracifolia		Fireweed		M, S	All		
Erigeron philadelphicus		Philadelphia Fleabane; Marsh Fleabane;		S	All		
Eriocaulon aquaticum	*E. septangulare*	Seven-angled Pipewort; Aquatic Pipewort	Y	M, W	All		Y
Eriophorum angustifolium		Narrow-leaved Cotton-grass; Tall Cotton-grass	Y	F	All		Y
Eriophorum gracile		Slender Cotton-grass	Y	F	All		
Eriophorum russeolum		Rusty Cotton-grass; Russet Cotton-grass	Y	F	North		
Eriophorum tenellum		Rough Cotton-grass	Y	F	All		
Eriophorum vaginatum	*E. spissum*	Tussock Cotton-grass; Sheathed Cotton-grass	Y	B	All		
Eriophorum virginicum		Tawny Cotton-grass	Y	F	All		Y
Eriophorum viridi-carinatum		Green-keeled Cotton-grass	Y	F	All		
Eupatorium maculatum	*Eupatoriadelphus maculatus*	Spotted Joe-pye-weed	Y	M, S	All		Y
Eupatorium perfoliatum		Common Boneset	Y	M, S	All		
Fimbristylis autumnalis		Slender Fimbristylis; Slender Fimbry	Y	M	South		
Fimbristylis puberula	*F. spadicea; F. puberula* var. *puberula*	Hairy Fimbristylis	Y	M	South		
Floerkea proserpinacoides		False Mermaid		S	All		Y
Frangula alnus	*Rhamnus frangula*	Glossy Buckthorn		M, S, F	All	Y	Y
Fraxinus nigra		Black Ash	Y	S	All		Y
Fraxinus pennsylvanica		Green Ash		S	All		Y
Fraxinus profunda	*F. tomentosa*	Pumpkin Ash	Y	S	South		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Galium asprellum		Rough Bedstraw	Y	M	All		
Galium brevipes		Limestone Swamp Bedstraw	Y	M	All		
Galium labradoricum		Bog Bedstraw	Y	F	All		
Galium obtusum		Blunt-leaf Bedstraw		M, S	South		
Galium palustre		Marsh Bedstraw	Y	M	All		
Galium tinctorium	*G. trifidum* var. *tinctorium*	Stiff Marsh Bedstraw	Y	M, S, F	All		
Galium trifidum	*G. brandegei*	Small Bedstraw	Y	M, S	All		
Gaultheria hispidula		Creeping Snowberry	Y (South)	S, F, B	All		
Gentiana andrewsii		Fringe-top Bottle Gentian		M, S	All		
Gentiana linearis		Narrow-leaved Gentian	Y	M, F	All		
Gentiana rubricaulis		Closed Gentian; Purple-stemmed Gentian	Y	M, S	All		
Gentianopsis crinita	*Gentiana crinita*	Fringed Gentian	Y	M, F	All		Y
Gentianopsis procera	*G. virgata, Gentiana procera; Gentiana crinita* ssp. *procera*	Smaller Fringed Gentian	Y	M, F	South		Y
Geocaulon lividum	*Comandra livida*	Northern Comandra		F	All		
Geum aleppicum		Yellow Avens		M, S	All		
Geum canadense		White Avens		S	All		
Geum laciniatum		Rough Avens		S	All		
G. macrophyllum		Large-leaved Avens		M, S	North		
Geum rivale		Purple Avens; Water Avens	Y	M, S	All		
Geum vernum		Spring Avens		S	South		
Glyceria borealis		Small Floating Manna Grass; Northern Manna Grass	Y	M, S, F	All		Y
Glyceria canadensis		Canada Manna Grass; Rattlesnake Manna Grass	Y	M, F	All		Y
Glyceria grandis		American Manna Grass; Tall Manna Grass	Y	M	All		Y
Glyceria maxima		Reed Meadowgrass; Rough Manna Grass	Y	M, S	South	Y	Y
Glyceria melicaria		Slender Manna Grass; Long Manna Grass; Melic Manna Grass	Y	M, S	North		
Glyceria septentrionalis		Floating Manna Grass	Y	M, S	South		Y
Glyceria striata		Fowl Manna Grass	Y	M, S	All		Y
Gnaphalium uliginosum		Low Cudweed; Marsh Cudweed		M	All	Y	
Gratiola aurea		Golden Hedge-hyssop	Y	M	North		
Gratiola neglecta		Clammy Hedge-hyssop		M, S	All		
Gratiola quartermaniae		Limestone Hedge-hyssop		M	South		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Gymnocarpium dryopteris		Oak Fern		S	All		
Helenium autumnale		Common Sneezeweed		M	All		
Helianthus giganteus		Tall Sunflower		M, S	All		
Helianthus grosseserratus		Saw-tooth Sunflower		M, S	South		
Heracleum maximum	*H. lanatum*	Cow-parsnip		M, S	All		
Heteranthera dubia	*Zosterella dubia*	Grassleaf Mud-plantain; Water Star-grass	Y	M, W	All		
Hibiscus moscheutos		Swamp Rose-mallow	Y	M	South		
Hierochloe odorata	*Anthoxanthum hirtum*	Holy Grass; Sweet Grass		M	All		
Hippuris vulgaris		Common Mare's-tail	Y	M, F	All	Y	
Hordeum jubatum		Foxtail Barley		M	All		
Hydrocharis morsus-ranae		European Frogbit	Y	M, W	All	Y	Y
Hydrocotyle americana		American Water-pennywort	Y	M, S	All		
Hypericum boreale	*H. mutilum* ssp. *boreale*	Northern St. John's-wort	Y	M, F	All		
Hypericum canadense		Canadian St. John's-wort	Y	M	All		
Hypericum ellipticum		Pale St. John's-wort	Y	M	All		
Hypericum kalmianum		Kalm St. John's-wort		M, F	South		Y
Hypericum majus		Larger Canadian St. John's-wort	Y	M, S	All		
Hypericum mutilum	*H. mutilum* ssp. *mutilum*	Slender St. John's-wort; Dwarf St. John's-wort	Y	M	South		
Hypericum punctatum		Common St. John's-wort		S	South		
Ilex verticillata		Winterberry; Black Holly	Y	M, S, F	All		Y
Impatiens capensis		Spotted Jewel-weed; Spotted Touch-me-not	Y	M, S	All		Y
Impatiens pallida		Pale Jewel-weed		S	South		Y
Inula helenium		Elecampane Flower		M	All	Y	Y
Iris brevicaulis		Short-stemmed Iris; Leafy Blue Flag	Y	S	South		
Iris pseudacorus		Yellow Iris	Y	M	South	Y	Y
Iris versicolor		Wild Blue Flag	Y	M, S	All		Y
Iris virginica		Virginia Blue Flag; Southern Blue Flag	Y	M	South		
Isoetes echinospora		Spiny-spore Quillwort	Y	M, W	All		Y
Isoetes engelmanii		Engelmann's Quillwort	Y	M, W	North		Y
Isoetes lacustris	*I. macrospora*	Western Quillwort	Y	M, W	North		Y
Isoetes riparia		Riverbank Quillwort	Y	M, W	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Isoetes tuckermannii		Tuckerman's Quillwort	Y	M, W	North		Y
Juncus acuminatus		Sharp-fruited Rush		M	All		
Juncus alpinoarticulatus	*J. alpinus*	Richardson Rush	Y	M	All		Y
Juncus articulatus		Jointed Rush	Y	M	All		Y
Juncus balticus	*J. arcticus* ssp. *balticus*	Baltic Rush	Y	M	All		Y
Juncus brachycephalus		Small-head Rush	Y	M	All		Y
Juncus brevicaudatus		Narrow-panicled Rush	Y	M	North		Y
Juncus bufonius		Toad Rush		M	All		
Juncus canadensis		Canada Rush	Y	M, F	All		Y
Juncus compressus		Flattened Rush; Roundfruit Rush		M	South	Y	Y
Juncus dudleyi		Dudley's Rush		M, F	All		Y
Juncus effusus var. *effusus*		Soft Rush	Y	M, S	All		Y
Juncus effusus var. *pylaei*	*J. pylaei*	Soft Rush	Y	M, S	All		Y
Juncus inflexus		European Meadow Rush; Incurved Rush		M	South	Y	
Juncus filiformis		Thread Rush	Y	M	North		
Juncus gerardii		Black-grass Rush; Saltmeadow Rush	Y	M	South	Y	
Juncus interior		Inland Rush		M	All		
Juncus marginatus		Grass-leaved Rush	Y	M	South		
Juncus militaris		Bayonet Rush	Y	M	North		Y
Juncus nodosus		Knotted Rush	Y	M, S	All		Y
Juncus pelocarpus		Brown-fruited Rush	Y	M	All		Y
Juncus stygius	*J. stygius* ssp. *americanus*	Moor Rush	Y	B	North		
Juncus subtilis		Creeping Rush	Y	M	North		
Juncus torreyi		Torrey's Rush		M	All		Y
Juncus triglumis	*J. triglumis* var. *albescens; J. albescens*	Three-flowered Rush; Three-hulled Rush	Y	F	North		
Juncus vaseyi	*J. greenei* var. *vaseyi*	Vasey's Rush		M	All		
Justicia americana		American Water-willow	Y	M	South		Y
Kalmia angustifolia		Sheep-laurel	Y (South)	F, B	All		Y
Kalmia polifolia		Pale Laurel; Bog Laurel	Y	F, B	All		Y
Laportea canadensis		Wood Nettle		S	All		Y
Larix laricina		Tamarack; American Larch	Y	S, F	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Lathyrus palustris		Vetchling Peavine	Y	M	All		
Ledum groenlandicum		Common Labrador Tea	Y	F, B	All		Y
Leersia oryzoides		Rice Cutgrass	Y	M, S	All		Y
Leersia virginica		Virginia Cutgrass; White Cutgrass		S	South		
Lemna minor		Lesser Duckweed; Common Duckweed	Y	M, W	All		Y
Lemna trisulca		Star Duckweed	Y	M, W	All		Y
Leptochloa fusca	*L. acuminata; L. fascicularis* var. *acuminata; Diplachne acuminata*	Saltpond Grass; Sprangletop; Salt-meadow Grass; Bearded Sprangletop		M	South	Y	
Liatris spicata		Dense Blazing-star; Spiked Blazing-star		M	South		
Lilium canadense		Canada Lily		S	South		
Lilium michiganense		Michigan Lily		S	South		
Limosella aquatica		Northern Mudwort	Y	M	South		
Lindera benzoin		Spicebush		S	South		Y
Lindernia dubia var. *anagallidea*		Slender False Pimpernel	Y	M	South		Y
Lindernia dubia var. *dubia*		Doubtful False Pimpernel	Y	M	All		Y
Linum medium var. *medium*		Stiff Yellow Flax		M	All		
Linum medium var. *texanum*		Texas Stiff Yellow Flax		M	South		
Linum striatum		Ridged Yellow Flax		M	All		
Linnaea borealis		Twinflower		S	All		Y
Liparis loeselii		Loesel's Twayblade	Y	M, S, F	All		
Lipocarpha micrantha	*Hemicarpha micrantha*	Small-flowered Lipocarpha	Y	M	All		Y
Listera auriculata		Auricled Twayblade	Y	S	North		
Listera australis		Southern Twayblade	Y	F	All		
Listera borealis		Northern Twayblade	Y	S, F	North		
Listera convallarioides		Broad-leaved Twayblade; Broad-lipped Twayblade	Y	S	All		
Listera cordata		Heartleaf Twayblade	Y (South)	S	All		
Littorella uniflora	*L. americana*	American Shoreweed	Y	M	North		
Lobelia cardinalis		Cardinal Flower	Y	M, S	All		
Lobelia dortmanna		Water Lobelia	Y	M	All		Y
Lobelia kalmii		Kalm's Lobelia	Y	M, F	All		Y
Lobelia siphilitica		Great Blue Lobelia	Y	M, S	All		
Lomatogonium rotatum		Marsh-felwort	Y	M	North		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Lonicera oblongifolia		Swamp Fly-honeysuckle	Y	S, F	All		
Lonicera villosa		Mountain Fly-honeysuckle	Y	S, F	All		
Ludwigia alternifolia		Bushy Seedbox	Y	M	South		
Ludwigia palustris		Marsh Seedbox; Marsh Purslane	Y	M	All		Y
Ludwigia polycarpa		Many-fruit Primrose-willow; Many-seeded False-loosestrife	Y	M, S	South		
Lycopodiella inundata	*Lycopodium inundatum*	Northern Bog Clubmoss		M, F	All		
Lycopus americanus		American Bugleweed; American Water-horehound	Y	M, S	All		Y
Lycopus asper		Rough Bugleweed; Rough Water-horehound	Y	M, S	All		
Lycopus europaeus		European Bugleweed; European Water-horehound	Y	M, S	South	Y	Y
Lycopus rubellus		Taper-leaved Bugleweed; Stalked Water-horehound	Y	S	South		
Lycopus uniflorus		Northern Bugleweed; Northern Water-horehound	Y	M, S	All		Y
Lycopus virginicus		Virginia Bugleweed; Virginia Water-horehound	Y	M, S	South		
Lysimachia ciliata		Fringed Loosestrife		M, S	All		Y
Lysimachia quadriflora		Four-flowered Loosesfrife	Y	M	South		
Lysimachia terrestris		Swamp Loosestrife; Bulb-bearing Loosestrife; Swamp Candles	Y	M, S, F	All		
Lysimachia thyrsiflora		Water Loosestrife; Yellow Loosestrife; Tufted Loosestrife	Y	M, S, F	All		Y
Lysimachia vulgaris		Garden Loosestrife		M	South	Y	Y
Lythrum alatum		Winged Loosestrife		M	South		
Lythrum hyssopifolia		Hyssop-leaved Loosestrife		M	South	Y	
Lythrum salicaria		Purple Loosestrife	Y	M, S	All	Y	Y
Maianthemum trifolium	*Smilacina trifolia*	Three-leaf Solomon's-seal	Y	S, F, B	All		Y
Malaxis monophyllos		White Adder's-mouth	Y	S, F	All		
Malaxis paludosa		Bog Adder's-mouth	Y	S, F	North		
Matteuccia struthiopteris		Ostrich Fern		M, S	All		Y
Megalodonta beckii	*Bidens beckii*	Water-marigold; Beck's Water-marigold	Y	M, W	All		Y
Menispermum canadense		Canada Moonseed		S	All		
Mentha arvensis		Corn Mint; American Wild Mint	Y	M, S	All		Y
Mentha spicata		Spearmint		M	South	Y	
Mentha suaveolens		Apple Mint; Round-leaved Mint		M	South	Y	
Mentha X piperita		Peppermint	Y	M	All	Y	Y
Mentha X villosa	*M. spicata X M. suaveolens*	Foxtail Mint; Wooly Mint		M	South	Y	

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Menyanthes trifoliata		Bog Buckbean; Three-leaved Buckbean	Y	S, F	All		Y
Mertensia paniculata		Tall Bluebells; Northern Bluebells		S	North		Y
Micranthes pensylvanica	*Saxifraga pensylvanica*	Eastern Swamp Saxifrage	Y	S	North		
Mimulus alatus		Sharp-winged Monkeyflower	Y	M, S	South		
Mimulus glabratus	*M. glabratus* var. *jamesii*	Round-leaved Monkeyflower; Glabrous Monkey-flower; James' Monkeyflower	Y	M	All		
Mimulus moschatus		Muskflower	Y	M	All		
Mimulus ringens		Square-stemmed Monkeyflower	Y	M	All		
Mitella diphylla		Two-leaf Bishop's Cap; Two-leaf Mitrewort		S	All		
Mitella nuda		Naked Bishop's Cap; Naked Mitrewort	Y (South)	S	All	Y	
Monarda didyma		Scarlet Beebalm; Oswego-tea		M	South		
Moneses uniflora	*Pyrola uniflora*	One-flower Wintergreen		S	All		
Muhlenbergia frondosa		Wire-stemmed Muhly		M, S	All		
Muhlenbergia glomerata		Marsh Muhly; Marsh Wild-timothy	Y	M, F	All		
Muhlenbergia mexicana		Mexican Muhly		M, S	All		
Myosotis laxa		Small Forget-me-not	Y	M, S	South		Y
Myosotis scorpioides		True Forget-me-not	Y	M, S	South	Y	Y
Myosoton aquaticum	*Stellaria aquatica*	Giant-chickweed		M, S	All	Y	
Myrica gale		Sweet Bayberry; Sweet Gale	Y	M, S, F	All		Y
Myriophyllum alterniflorum		Alternate-flowered Water-milfoil	Y	M, W	North		
Myriophyllum farwellii		Farwell's Water-milfoil	Y	M, W	North		
Myriophyllum heterophyllum		Broadleaf Water-milfoil	Y	M, W	All		Y
Myriophyllum sibiricum	*M. exalbescens*	Common Water-milfoil	Y	M, W	All		Y
Myriophyllum spicatum		Eurasian Water-milfoil	Y	M, W	All	Y	Y
Myriophyllum tenellum		Slender Water-milfoil	Y	M, W	North		
Myriophyllum verticillatum		Whorled Water-milfoil	Y	M, W	All		Y
Najas flexilis		Slender Naiad; Bushy Naiad	Y	M, W	All		Y
Najas gracillima		Thread-like Naiad	Y	M, W	North		
Najas guadalupensis		Southern Naiad	Y	M, W	All		
Najas marina		Prickly Naiad	Y	M, W	South		
Najas minor		Brittle Naiad	Y	M, W	South	Y	

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Nelumbo lutea		American Lotus	Y	M, W	South		Y
Nemopanthus mucronatus		Mountain Holly	Y	M, S, F	All		Y
Nuphar advena		Large Yellow Pond-lily	Y	M, W	South		Y
Nuphar lutea ssp. *rubrodisca*	*N. rubrodisca*	Red-disked Yellow Pond-lily	Y	M, W	North		Y
Nuphar lutea ssp. *variegata*	*N. variegata*	Yellow Cowlily; Bulhead Pond-lily; Varigated Yellow Pond-lily	Y	M, W	All		Y
Nuphar microphylla		Small Yellow Pond-lily	Y	M, W	North		Y
Nymphaea leibergii	*N. tetragona*	Small White Water-lily; Pygmy Water-lily	Y	M, W	North		
Nymphaea odorata	*N. tuberosa*	White Water-lily; Fragrant Water-lily	Y	M, W	All		Y
Nymphoides cordata		Floating-heart	Y	M, W	North		Y
Nyssa sylvatica		Black Gum	Y	S	South		Y
Oclemena nemoralis	*Aster nemoralis*	Bog Aster	Y	M, F	All		
Onoclea sensibilis		Sensitive Fern	Y	M, S	All		Y
Ophioglossum pusillum	*O. vulgatum* var. *pseudopodum*	Northern Adder's-tongue		M, F	All		
Orthilia secunda	*Pyrola secunda*	One-sided Wintergreen; One-sided Shinleaf		S	All		
Osmunda cinnamomea		Cinnamon Fern	Y	S, F	All		Y
Osmunda claytoniana		Interrupted Fern		S	All		
Osmunda regalis		Royal Fern	Y	S, F	All		Y
Oxalis montana	*O. acetosella* ssp. *montana*	True Wood-sorrel		S	All		
Oxypolis rigidior		Stiff Cowbane		S	South		
Packera aurea	*Senecio aureus*	Golden Ragwort; Golden Groundsel	Y	S	All		
Packera indecora	*Senecio indecorus*	Plains Ragwort; Elegant Groundsel		M	North		
Packera paupercula	*Senecio pauperculus*	Balsam Ragwort; Balsam Groundsel		M	All		Y
Panax trifolius		Dwarf Ginseng		S	South		
Panicum flexile		Wiry Witch Grass; Wiry Panic Grass	Y	M	All		
Panicum rigidulum		Redtop Panic Grass		M	All		Y
Panicum tuckermanii		Tuckerman's Panic Grass	Y	M	All		Y
Parnassia glauca		Carolina Grass-of-parnassus; American Grass-of-parnassus	Y	F	All		
Parnassia palustris		Marsh Grass-of-parnassus	Y	F	All		
Parnassia parviflora		Small-flower Grass-of-parnassus	Y	F	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Pedicularis groenlandica		Blue-elephant's-head; Elephanthead Lousewort	Y	F	North		
Pedicularis lanceolata		Swamp Lousewort; Swamp Wood-betony	Y	M, S	All		
Pedicularis parviflora	*P. macrodonta*	Small-flowered Lousewort; Sparse-flowered Wood-betony; Muskeg Lousewort		F	North		
Peltandra virginica		Green Arrow-arum	Y	M, S, F	All		Y
Penthorum sedoides		Ditch-stonecrop	Y	M, S	South		Y
Persicaria amphibia	*P. natans, Polygonum amphibium*	Water Smartweed	Y	M, W	All		Y
Persicaria arifolia	*Polygonum arifolium*	Halberd-leaved Tearthumb	Y	M, S	South		
Persicaria careyi	*Polygonum careyi*	Carey's Smartweed; Carey's Knotweed	Y	M	All		
Persicaria hydropiper	*Polygonum hydropiper*	Marshpepper Smartweed; Water-pepper	Y	M	All		Y
Persicaria hydropiperoides	*Polygonum hydropiperoides*	Mild Water-pepper	Y	M, S	All		Y
Persicaria lapathifolia	*Polygonum lapathifolium*	Dock-leaf Smartweed; Pale Smartweed		M	All		
Persicaria maculosa	*Polygonum persicaria*	Lady's-thumb		M	All	Y	Y
Persicaria pensylvanica	*Polygonum pensylvanicum*	Pennsylvania Smartweed	Y	M	All		Y
Persicaria punctata	*Polygonum punctatum*	Dotted Smartweed; Water Smartweed	Y	M, S	All		Y
Persicaria sagittata	*Polygonum sagittatum*	Arrow-leaved Tearthumb	Y	M	All		Y
Petasites frigidus	*P. palmatus*	Sweet Coltsfoot	Y (South)	M, S	All		
Petasites japonicus	*P. hybridus*	Japanese Butter-bur; Japanese Sweet Coltsfoot; Butterfly-dock		M, S	South	Y	
Petasites sagittatus		Arrow-leaved Sweet-coltsfoot	Y	S	North		
Petasites X vitifolius	*Petasites frigidus* var. *vitifolius; Petasites frigidus X P. sagittatus*	Hybrid Sweet-coltsfoot		S	North		
Phalaris arundinacea		Reed Canary Grass		M, S	All	some non-native genotypes	Y
Phegopteris connectilis		Northern Beech Fern		S	All		
Phlox maculata	*Phlox maculata* ssp. *maculata*	Spotted Phlox; Wild Sweet William		M	South	Y	
Photinia melanocarpa	*Aronia melanocarpa; Aronia prunifolia*	Black Chokeberry	Y (South)	M, S, F, B,	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Phragmites australis ssp. *americanus*		American Reedgrass	Y	M, S, F	All		Y
Phragmites australis ssp. *australis*		Common Reed		M, S	All	Y	Y
Phyla lanceolata	*Lippia lanceolata*	Fog-fruit	Y	M	South		
Physocarpus opulifolius		Eastern Ninebark		M, S	All		Y
Physostegia virginiana		False Dragon-head; Obedient Plant	Y	M	All		
Picea glauca		White Spruce		S	All		Y
Picea mariana		Black Spruce	Y (South)	S, F, B	All		Y
Pilea fontana		Spring Clearweed	Y	M, S	South		Y
Pilea pumila		Canada Clearweed; Dwarf Clearweed	Y	M, S	South		Y
Pinguicula vulgaris		Butterwort	Y	F	All		
Pinus strobus		Eastern White Pine		S, F	All		Y
Plantago cordata		Heart-leaved Plantain	Y	S	South		
Platanthera aquilonis	*P. hyperborea*	Tall Northern Green Orchid; Tall Leafy Green Orchid	Y	S, F	All		
Platanthera blephariglottis		White-fringed Orchid	Y	F	All		
Platanthera clavellata		Small Green Woodland Orchid; Little Club-spur Orchid	Y	M, S, F	All		
Platanthera dilatata		Leafy White Orchid; Tall White Bog Orchid; Fragrant White Orchid	Y	F	All		
Platanthera flava var. *herbiola*		Tubercled Orchid	Y	M, S, F	All		
Platanthera grandiflora	*P. psycodes* var. *grandiflora*	Large-flowered Purple-fringed Orchid; Greater Purple Fringed Orchid		S, F	South		
Platanthera lacera		Ragged Fringed Orchid; Green Fringed Orchid	Y	M, S, F	All		
Platanthera leucophaea		Eastern Prairie-fringed Orchid		M, F	South		
Platanthera obtusata		Small Northern Bog Orchid; Blunt-leaf Orchid	Y	S, F	All		
Platanthera psycodes		Small Purple-fringed Orchid	Y	M, S, F	All		
Platanus occidentalis		Sycamore		S	South		
Poa palustris		Fowl Bluegrass; Swamp Blue Grass	Y	M, S	All		Y
Podostemum ceratophyllum		Horn-leaved Riverweed	Y	W	North		Y
Pogonia ophioglossoides		Rose Pogonia	Y	F	All		
Pontederia cordata		Pickerel Weed	Y	M, W	All		Y
Populus balsamifera		Balsam Poplar		S	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Populus deltoides		Eastern Cottonwood		S	All		Y
Populus heterophylla		Swamp Cottonwood	Y	S	South		
Populus tremuloides		Trembling Aspen		S	All		Y
Potamogeton alpinus		Northern Pondweed	Y	M, W	All		
Potamogeton amplifolius		Large-leaf Pondweed	Y	M, W	All		Y
Potamogeton bicupulatus		Snailseed Pondweed; Two-cupped Pondweed	Y	M, W	All		
Potamogeton confervoides		Algae Pondweed	Y	M, W	All		
Potamogeton crispus		Curly Pondweed	Y	M, W	All	Y	Y
Potamogeton epihydrus		Ribbon-leaf Pondweed	Y	M, W	All		Y
Potamogeton filiformis	*Stuckenia filiformis*	Threadleaf Pondweed; Fine-leaved Pondweed	Y	M, W	All		Y
Potamogeton foliosus		Leafy Pondweed	Y	M, W	All		Y
Potamogeton friesii		Fries' Pondweed	Y	M, W	All		
Potamogeton gramineus		Grassy Pondweed	Y	M, W	All		Y
Potamogeton hillii		Hill's Pondweed	Y	M, W	All		Y
Potamogeton illinoensis		Illinois Pondweed	Y	M, W	All		Y
Potamogeton natans		Floating Pondweed	Y	M, W	All		Y
Potamogeton nodosus		Longleaf Pondweed	Y	M, W	All		
Potamogeton oakesianus		Oakes Pondweed	Y	M, W	All		
Potamogeton obtusifolius		Blunt-leaf Pondweed	Y	M, W	All		
Potamogeton ogdenii		Ogden's Pondweed	Y	M, W	South		
Potamogeton pectinatus	*Stuckenia pectinata*	Sago Pondweed	Y	M, W	All		Y
Potamogeton perfoliatus		Clasping-leaf Pondweed	Y	M, W	All		Y
Potamogeton praelongus		White-stem Pondweed	Y	M, W	All		Y
Potamogeton pulcher		Spotted Pondweed	Y	M, W	South		
Potamogeton pusillus ssp. *pusillus*		Slender Pondweed	Y	M, W	All		Y
Potamogeton pusillus ssp. *tenuissimus*	*P. berchtoldii*	Slender Pondweed	Y	M, W	All		Y
Potamogeton richardsonii		*R*edheadgrass; Richardson's Pondweed	Y	M, W	All		Y
Potamogeton robbinsii		Flatleaf Pondweed; Robbins' Pondweed	Y	M, W	All		Y
Potamogeton spirillus		Spiral Pondweed	Y	M, W	All		
Potamogeton strictifolius		Straight-leaf Pondweed	Y	M, W	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Potamogeton vaginatus	*Stuckenia vaginata*	Sheathed Pondweed	Y	M, W	All		
Potamogeton vaseyi		Vasey's Pondweed	Y	M, W	All		
Potamogeton zosteriformis		Flatstem Pondweed	Y	M, W	All		Y
Potentilla norvegica		Norwegian Cinquefoil		M	All		
Potentilla reptans		Creeping Cinquefoil		M	South	Y	
Potentilla supina	*P. paradoxa*	Bushy Cinquefoil		M	All		
Prenanthes alba		White Rattlesnake-root; White Lettuce		S	All		
Primula mistassinica		Bird's-eye Primrose		M, F	All		Y
Proserpinaca palustris		Marsh Mermaid-weed	Y	M	All		
Prunella vulgaris ssp. *lanceolata*		Self-heal; Heal-all		M, S	All		
Puccinellia distans	*P. distans* ssp. *distans*	Spreading Alkali Grass		M	All	Y	Y
Pycnanthemum virginianum		Virginia Mountain-mint		M	South		
Pyrola asarifolia	*P. rotundifolia* var. *asarifolia*	Pink Wintergreen; Pink Pyrola		S, F	All		
Pyrola minor		Lesser Wintergreen		S	North		
Quercus bicolor		Swamp White Oak	Y	S	South		Y
Quercus macrocarpa		Bur Oak; Mossy-cup Oak		S	All		Y
Quercus palustris		Pin Oak		S	South		Y
Quercus shumardii		Shumard Oak; Swamp Red Oak	Y	S	South		
Ranunculus acris		Tall Buttercup		M, S	All	Y	
Ranunculus aquatilis	*R. longirostris*	White Water-crowfoot	Y	M, W	All		Y
Ranunculus cymbalaria		Seaside Crowfoot	Y	M	All		Y
Ranunculus ficaria		Lesser-celandine		S	South	Y	
Ranunculus flabellaris		Yellow Water-crowfoot	Y	M, S	South		Y
Ranunculus flammula var. *reptans*	*R. reptans*	Creeping Spearwort	Y	M, W	All		
Ranunculus gmelinii		Small Yellow Water-crowfoot	Y	M, W	All		
Ranunculus hispidus var. *caricetorum*	*R. septentrionalis*	Swamp Buttercup	Y	S	All		Y
Ranunculus lapponicus		Lapland Buttercup	Y	S	North		
Ranunculus pensylanicus		Bristly Buttercup; Bristly Crowfoot	Y	M, S	All		
Ranunculus sceleratus		Cursed Crowfoot; Cursed Buttercup	Y	M, S	All		Y
Rhamnus alnifolia		Alder-leaved Buckthorn	Y	S, F	All		
Rhamnus cathartica		Common Buckthorn; European Buckthorn		S	All	Y	Y
Rhexia virginica		Virginia Meadow-beauty	Y	M	North		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Rhododendron canadense		Rhodora	Y	F	South		
Rhynchospora alba		White Beakrush	Y	F	All		Y
Rhynchospora capillacea		Capillary Beakrush	Y	F	All		Y
Rhynchospora capitellata		Brownish Beakrush; Small-headed Beakrush	Y	Y	M	All	
Rhynchospora fusca		Brown Beakrush	Y	M	All		Y
Ribes americanum		Wild Black Currant; American Black Currant		M, S	All		
Ribes glandulosum		Skunk Currant	Y	S	All		
Ribes hirtellum		Smooth Gooseberry; Wild Gooseberry	Y	S, F	All		
Ribes hudsonianum		Northern Wild Black Currant; Hudson Bay Currant	Y	S	All		
Ribes lacustre		Bristly Black Currant; Swamp Gooseberry	Y	S	All		
Ribes rubrum		Northern Red Currant		S	All	Y	
Ribes triste		Swamp Red Current; Wild Red Currant	Y	S	All		
Rorippa aquatica	*Neobeckia aquatica; Armoracia aquatica; Armoracia lacustris*	Lakecress	Y	M, W	All		
Rorippa microphylla	*Nasturtium microphyllum*	One-row Water-cress; Small-leaved Water-cress	Y	M, S	All	Y	Y
Rorippa palustris		Marsh Yellow-cress	Y	M	All		Y
Rorippa sylvestris		Creeping Yellow-cress		M	All	Y	
Rosa palustris		Swamp Rose	Y	M, S	All		
Rotala ramosior		Toothcup; Rotala	Y	M	South		
Rubus acaulis		Stemless Raspberry; Northern Dwarf Raspberry	Y	S, F	North		
Rubus chamaemorus		Cloudberry	Y	S, F	North		
Rubus hispidus		Bristly Dewberry; Swamp Dewberry		S, F	All		
Rubus pubescens		Dwarf Raspberry; Catherinettes Berry	Y (South)	M, S	All		Y
Rubus setosus		Small Bristleberry; Bristly Blackberry		S	All		Y
Rudbeckia fulgida	*R. sullivanti; R. speciosa* var. *sullivanttii; R. fulgida* var. *speciosa*	Orange Coneflower		M	South		
Rudbeckia laciniata	*R. laciniata* var. *laciniata*	Cut-leaved Coneflower		M, S	All		
Rumex altissimus		Pale Dock; Peach-leaved Dock		M, S	South		
Rumex crispus		Curled Dock		M, S	All	Y	

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Rumex fueginus	*R. maritimus* ssp. *fueginus*	Seaside Dock; Golden Dock	Y	M	All		
Rumex obtusifolius		Bitter Dock		M, S	All	Y	
Rumex occidentalis	*R. aquaticus* var. *fenestratus*	Western Dock	Y	M, S	North		
Rumex orbiculatus		Great Water Dock	Y	M, S	All		
Rumex sanguineus		Red Vine Dock; Redvein Dock		M	South	Y	
Rumex verticillatus		Swamp Dock	Y	M	South		
Sagittaria cristata	*S. graminea* var. *cristata*	Crested Arrowhead	Y	M, W	All		Y
Sagittaria cuneata		Wapatum Arrowhead; Northern Arrowhead	Y	M, W	All		Y
Sagittaria graminea	*S. graminea* var. *graminea*	Grassleaf Arrowhead	Y	M, W	All		Y
Sagittaria latifolia		Broadleaf Arrowhead	Y	M, W, S	All		Y
Sagittaria rigida		Sessile-fruited Arrowhead	Y	M, W	All		Y
Salix alba		White Willow		S	All	Y	Y
Salix amygdaloides		Peach-leaved Willow		S	All		Y
Salix bebbiana		Bebb's Willow	Y	M, S	All		Y
Salix candida		Hoary Willow	Y	F	All		
Salix discolor		Pussy Willow	Y	M, S	All		Y
Salix eriocephala	*S. rigida*	Heart-leaved Willow; Missouri Willow		M, S	All		Y
Salix interior		Sandbar Willow		M, S	All		Y
Salix glauca	*S. glauca* ssp. *callicarpaea*	Gray Willow; Northern Willow		M, F	North		
Salix lucida		Shining Willow	Y	M, S	All		Y
Salix maccalliana		McCalla's Willow	Y	S	North		
Salix myricoides	*S. glaucophylloides; S. myricoides* var. *myricoides*	Blue-leaved Willow		S	All		
Salix myrtillifolia		Myrtle-leaved Willow; Blueberry Willow		S	North		
Salix nigra		Black Willow		S	All		Y
Salix pedicellaris		Bog Willow	Y	F	All		
Salix pellita		Satiny Willow		M, S	North		
Salix petiolaris		Slender Willow; Meadow Willow	Y	M, S	All		Y
Salix planifolia	*S. phylicifolia; S. planifolia* ssp. *planifolia*	Tea-leaved Willow; Flat-leaved Willow; Diamond-leaf Willow	Y	M, S, F	North		
Salix pseudomoniticola	*S. monticola*	False Mountain Willow		S	North		
Salix purpurea		Basket Willow		S	South	Y	Y
Salix pyrifolia		Balsam Willow	Y	M, S, F	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Salix serissima		Autumn Willow	Y	S, F	All		Y
Salix X rubens		Reddish Willow		S	All	Y	Y
Sambucus nigra ssp. *canadensis*	*S. canadensis*	Common Elderberry		M, S	All		Y
Samolus valerandi	*S. parviflorus*	Valerand's Brookweed	Y	S	South		
Sarracenia purpurea		Northern Pitcher-plant	Y	F, B	All		Y
Saururus cernuus		Lizard's-tail	Y	M, S	South		Y
Scheuchzeria palustris		Pod-grass	Y	F	All		
Schoenoplectus acutus var. *acutus*	*Scirpus acutus*	Hard-stem Bulrush; Hard-stem Club-rush	Y	M, W, F	All		Y
Schoenoplectus fluviatilis	*Scirpus fluviatilis; Bolboschoenus fluviatilis*	River Club-rush; River Bulrush	Y	M	All		Y
Schoenoplectus heterochaetus	*Scirpus heterochaetus*	Slender Bulrush	Y	M, W	North		Y
Schoenoplectus maritimus	*Scirpus maritimus; Bolboschoenus maritimus*	Saltmarsh Club-rush; Saltmarsh Bulrush	Y	M	All	Y (South)	Y
Schoenoplectus pungens	*Scirpus americanus; Scirpus pungens*	Three-square	Y	M	All		Y
Schoenoplectus purshianus	*Scirpus purschianus*	Weak-stalk Bulrush; Pursh's Bulrush	Y	M	All		
Schoenoplectus smithii	*Scirpus smithii*	Smith's Bulrush; Smith's Club-rush	Y	M	All		
Schoenoplectus subterminalis	*Scirpus subterminalis*	Swaying Club-rush; Floating Bulrush	Y	M, W, F	All		Y
Schoenoplectus tabernaemontani	*Scirpus validus*	Soft-stem Bulrush; Soft-stem Club-rush	Y	M	All		Y
Schoenoplectus torreyi	*Scirpus torreyi*	Torrey's Bulrush; Torrey Three-square	Y	M	All		
Scirpus atrocinctus		Black-girdle Bulrush	Y	M	All		
Scirpus atrovirens		Dark-green Bulrush; Black Bulrush		M, S	All		Y
Scirpus cyperinus		Cottongrass Bulrush; Wool-grass	Y	M, S	All		Y
Scirpus expansus		Woodland Bulrush	Y	M	South		
Scirpus georgianus	*S. atrovirens* var. *georgianus*	Georgia Bulrush	Y	M	South		
Scirpus hattorianus		Mosquito Bulrush		S	All		
Scirpus microcarpus	*S. rubrotinctus*	Red-tinged Bulrush; Small-fruited Bulrush; Red-sheathed Bulrush	Y	M	All		Y
Scirpus pedicellatus		Stalked Bulrush	Y	M	All		Y
Scirpus pendulus	*S. lineatus*	Rufous Bulrush; Lined Bulrush	Y	M	All		Y
Scleria verticillata		Low Nutrush	Y	M	South		Y
Scutellaria galericulata	*S. epilobiifolia*	Hooded Skullcap	Y	M, S	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Scutellaria lateriflora		Mad-dog Skullcap	Y	M, S	All		Y
Selaginella eclipes	*S. apoda*	Meadow Spike-moss	Y	M, F	All		
Selaginella selaginoides		Low Spike-moss; Northern Spike-moss	Y	F	All		
Senecio congestus	*Tephroseris palustris*	Marsh Ragwort; Marsh Groundsel		M	North		
Sisyrinchium angustifolium		Pointed Blue-eyed-grass; Narrowleaf Blue-eyed-grass		M	All		
Sisyrinchium montanum	*S. bermudiana; S. montanum* var. *montanum*	Strict Blue-eyed-grass; Montane Blue-eyed-grass		M	All		
Sisyrinchium mucronatum		Michaux Blue-eyed-grass; Narrow-leaved Blue-eyed-grass		M	All		
Sium suave		Hemlock Water-parsnip	Y	M, S	All		Y
Solanum dulcamara		Climbing Nightshade; Bittersweet Nightshade		M, S	All	Y	Y
Solidago gigantea	*S. serotina*	Late Goldenrod; Giant Goldenrod		M, S	All		Y
Solidago houghtonii	*Oligoneuron houghtonii*	Houghton's Goldenrod		F	All		
Solidago ohioensis		Ohio Goldenrod	Y	F	All		
Solidago patula		Roundleaf Goldenrod; Rough-leaved Goldenrod	Y	M, S	South		Y
Solidago riddellii		Riddell's Goldenrod	Y	M	South		
Solidago rugosa		Rough-leaf Goldenrod; Rough Goldenrod		M, S	All		Y
Solidago uliginosa		Bog Goldenrod	Y	S, F	All		
Sonchus palustris		Marsh Sowthistle	Y	M	South	Y	Y
Sorbus americana		American Mountain-ash	Y (South)	M, S, F	All		
Sparganium americanum		American Bur-reed	Y	M, S	All		
Sparganium androcladum		Branching Bur-reed	Y	M	All		
Sparganium angustifolium		Many-stalked Bur-reed; Narrow-leaved Bur-reed	Y	M	All		
Sparganium emersum	*S. chlorocarpum*	Green-fruited Bur-reed	Y	M	All		Y
Sparganium eurycarpum		Large Bur-reed; Broad-fruited Bur-reed	Y	M	All		Y
Sparganium fluctuans		Floating Bur-reed	Y	M, W	All		Y
Sparganium glomeratum		Clustered Bur-reed	Y	S	North		
Sparganium natans	*S. minimum*	Small Bur-reed	Y	M, F	All		
Spartina pectinata		Freshwater Cordgrass		M	All		Y
Sphenopholis intermedia		Slender Wedgegrass		M, S	All		
Spiraea alba	*S. latifolia*	Narrow-leaved Meadow-sweet	Y	M, S, F	All		Y
Spiraea tomentosa		Hardhark Spiraea; Steeple-bush; Tomentose Meadow-sweet		M, F	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Spiranthes cernua		Nodding Ladies'-tresses		M, F	All		Y
Spiranthes lucida			Y	M, F	South		
Spiranthes romanzoffiana		Hooded Ladies'-tresses	Y	M, F	All		Y
Spirodela polyrhiza		Greater Duckweed; Common Water-flaxseed	Y	M, W	All		Y
Stachys palustris		Marsh Hedge-nettle	Y	M, S	All	Y	
Stachys pilosa	*S. palustris* var. *arenicola; S. pilosa* var. *arenicola; S. pilosa* var. *pilosa*	Sand Hedge-nettle; Hairy Hedge-nettle	Y	M	All		
Stachys tenuifolia var. *hispida*	*S. hispida; S. tenuifolia*	Hispid Hedge-nettle; Rough Hedge-nettle	Y	M, S	All		
Stellaria borealis	*S. calycantha; S. borealis* ssp. *borealis*	Northern Stitchwort		M, S	North		
Stellaria crassifolia	*S. crassifolia* var. *crassifolia*	Fleshy Stitchwort; Thick-leaved Starwort		M	North		
Stellaria graminea		Little Starwort; Grass-leaved Stitchwort		M	All	Y	
Stellaria longifolia		Long-leaved Stitchwort	Y	M, S	All		
Stellaria longipes	*S. longipes* ssp. *longipes*	Long-stalked Stitchwort		M	All		
Subularia aquatica		Water Awlwort	Y	M, W	North		
Symphyotrichum boreale	*Aster borealis; Aster junciformis*	Rush Aster; Northern Bog Aster	Y	M, F	All		
Symphyotrichum ciliatum	*Aster brachyactis*	Alkali Aster; Rayless Aster	Y	M	All	Y, native on James Bay *coast*	Y
Symphyotrichum dumosum	Aster dumosus	Bushy Aster	Y	M	South		
Symphyotrichum lanceolatum ssp. *lanceolatum*	*Aster lanceolatus* var. *lanceolatus; Aster simplex*	Panicled Aster	Y	M, S	All		Y
Symphyotrichum lateriflorum	*Aster lateriflorus*	Small White Aster; One-sided Aster; Calico Aster		S	All		
Symphyotrichum ontarionis	*Aster ontarionis*	Ontario Aster	Y	S	All		
Symphyotrichum pilosum var. *pringlei*	*Aster pilosus* var. *pringlei; Aster pringlei*	Pringle's Aster		M	South		
Symphyotrichum prenanthoides	*Aster prenanthoides*	Crooked-stem Aster	Y	S	South		
Symphyotrichum puniceum	*Aster puniceus*	Swamp Aster; Purple-stemmed Aster	Y	M, S	All		Y
Symphyotrichum robynsianum	*Aster robynsianus; Aster longifolius*	Long-leaved Aster; Robyns' Aster	Y	F	North		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Symphyotrichum subulatum	*Aster subulatus*	Annual Salt-marsh Aster	Y	M	South	Y	
Symplocarpus foetidus		Skunk-cabbage	Y	M, S	All		Y
Taraxacum ceratophorum	*T. officinale* ssp. *ceratophorum*	Horned Dandelion; Northern Dandelion		M	North		
Teucrium canadense		American Germander		M	All		
Thalictrum dasycarpum		Purple Meadow-rue		M, S	All		
Thalictrum pubescens	*T. polygamum*	Tall Meadow-rue		M, S	All		
Thalictrum venulosum		Veiny Meadow-rue		M, S	North		
Thelypteris palustris	*T. thelypteroides*	Marsh Fern	Y	M, S, F	All		Y
Thelypteris simulata		Bog Fern	Y	F	South		
Thuja occidentalis		Eastern White Cedar		S, F	All		Y
Tiarella cordifolia		Heart-leaved Foam-flower; False Mitrewort		S	All		
Tofieldia pusilla		Small False-asphodel; Scotch False Asphodel		F	North		
Torreyochloa pallida var. *fernaldii*	*Puccinellia fernaldii; T. fernaldii*	Fernald's Manna Grass	Y	M, S	All		
Torreyochloa pallida var. *pallida*	*Puccinellia pallida*	Torrey's Manna Grass; Pale Manna Grass	Y	M	South		
Toxicodendron radicans ssp. *negundo*	*Rhus radicans* var. *radicans*	Climbing Poison-Ivy		S	South		
Toxicodendron vernix	*Rhus vernix*	Poison Sumac	Y	S, F	South		Y
Triadenum fraseri	*Hypericum fraseri; T. virginicum* var. *fraseri*	Marsh St. John's-wort	Y	M, F	All		
Triadenum virginicum	*Hypericum virginicum*	Swamp St. John's-wort	Y	M, F	All		
Triantha glutinosa	*Tofieldia glutinosa*	Sticky False-asphodel	Y	F	All		
Trichophorum alpinum	*Scirpus hudsonianus*	Alpine Leafless-bulrush	Y	F	All		Y
Trichophorum caespitosum	*Scirpus cespitosus*	Tufted Leafless-bulrush	Y	F	All		Y
Triglochin maritima		Common Bog Arrow-grass	Y	M, F	All		Y
Triglochin palustris		Slender Bog Arrow-grass	Y	M, F	All		
Trillium cernuum		Nodding Trillium		S	All		
Tsuga canadensis		Eastern Hemlock		S	All		Y
Tussilago farfara		Coltsfoot		M, S	All	Y	Y
Typha angustifolia		Narrow-leaved Cattail	Y	M, S	All	Y	Y
Typha latifolia		Broad-leaved Cattail; Common Cattail	Y	M, S	All		Y
Typha X glauca		Blue Cattail; Hybrid Cattail	Y	M	All	Y	Y
Ulmus americana		American Elm; White Elm		S	All		Y
Urtica dioica ssp. *gracilis*	*U. gracilis*	American Stinging Nettle		M, S	All		Y

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Utricularia cornuta		Horned Bladderwort	Y	M, F	All		
Utricularia geminiscapa		Twin-stemmed Bladderwort; Hidden-fruited Bladderwort	Y	M, B	All		
Utricularia gibba		Humped Bladderwort	Y	M, F	All		
Utricularia intermedia		Flatleaf Bladderwort	Y	M, F	All		
Utricularia minor		Lesser Bladderwort; Small Bladderwort	Y	M, F	All		
Utricularia purpurea		Purple Bladderwort	Y	M, W	All		
Utricularia resupinata		Northeastern Bladderwort	Y	M, F	All		
Utricularia vulgaris	*U. macrorhiza*	Greater Bladderwort; Common Bladderwort	Y	M, W	All		Y
Vaccinium corymbosum		Highbush Blueberry	Y	S, F	All		Y
Vaccinium macrocarpon		Large Cranberry	Y	F, B	All		Y
Vaccinium myrtilloides		Velvetleaf Blueberry		S, F, B	All		
Vaccinium oxycoccos		Small Cranberry	Y	S, F, B	All		Y
Valeriana dioica	*V. sylvatica*	Wood Valerian; Northern Valerian	Y	F	North		
Valeriana edulis	*V. edulis* var. *ciliata*	Hairy Valerian; Taperooted Valerian	Y	M, F	South		
Valeriana uliginosa	*V. sitchensis* ssp. *uliginosa*	Mountain Valerian; Marsh Valerian	Y	M, F	South		
Valerianella umbilicata	*V. intermedia*	Navel Cornsalad		S	South		
Vallisneria americana		Eel-grass; Tape-grass	Y	M, W	All		Y
Verbena hastata		Blue Vervain	Y	M, S	All		
Verbena urticifolia		White Vervain		M, S	All		
Verbesina alternifolia	*Actinomeris alternifolia*	Wing-stem		S	South		
Veronica americana	*V. beccabunga* var. *americana*	American Speedwell	Y	M	All		
Veronica anagallis-aquatica		Brook-pimpernel; Water Speedwell	Y	M	All	Y	
Veronica beccabunga		European Speedwell; Bachbungen's Speedwell	Y	M	South	Y	
Veronica catenata		Sessile Water-speedwelll	Y	M	South		
Veronica peregrina ssp. *peregrina*		Purslane Speedwell		M	All		
Veronica scutellata		Marsh Speedwell	Y	M	All		
Viburnum nudum var. *cassinoides*	*V. cassinoides*	Northern Wild-raisin	Y (South)	F	All		
Viburnum edule		Squashberry; Lowbush Cranberry; Mooseberry		S	North		
Viburnum lentago		Nannyberry		M, S	All		Y
Viburnum opulus var. *americanum*	*V. trilobum*	Highbush Cranberry		M, S	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Viola affinis		Le Conte's Violet; Sand Violet		S	All		
Viola blanda	*V. incognita*	Sweet White Violet; Smooth White Violet		S	All		
Viola cucullata		Marsh Blue Violet	Y	S	All		
Viola epipsila	*V. palustris*	Northern Marsh Violet	Y	S	North		
Viola lanceolata		Lance-leaved Violet	Y	M, F	All		
Viola macloskeyi	*V. pallens*	Northern White Violet; Smooth White Violet	Y	S, F	All		
Viola nephrophylla		Northern Bog Violet	Y	M, S, F	All		
Viola renifolia		Kidney-leaved Violet	Y (South)	S	All		
Viola sororia		Woolly Blue Violet		S	All		
Viola striata		Striped Cream Violet		S	South		
Wolffia borealis	*W. punctata*	Dotted Water-meal; Northern Water-meal	Y	M, W	All		Y
Wolffia brasiliensis		Brasiian Water-meal	Y	M, W	North		
Wolffia columbiana	*W. arrhiza*	Columbia Water-meal	Y	M, W	All		Y
Woodwardia virginica		Virginia Chain Fern	Y	S, F, B	All		Y
Xanthium strumarium		Rough Cockle-bur		M	All		
Xyris difformis		Tall Yellow-eyed-grass; Two-formed Yellow-eyed-grass	Y	M	All		
Xyris montana		Northern Yellow-eyed-grass	Y	M, F	All		
Zannichellia palustris		Horned Pondweed	Y	M, W	All		
Zigadenus elegans	*Z. glaucus*	White Camass		F	All		
Zizania aquatica		Indian Wild Rice; Southern Wild Rice	Y	M, W	South		Y
Zizania palustris		Wild Rice	Y	M, W	All		Y
Zizia aurea		Common Alexanders; Golden Alexanders		M, S	South		

Non-Vascular Plants

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Aulacomnium palustre		Ribbed Bog Moss	Y	B, F, S	All		
Calliergon giganteum		Giant Water Moss	Y	F, S	North [1]		
Calliergon richardsonii		Richardson's Water Moss	Y	F, S	North [2]		
Calliergon stramineum		Straw-coloured Water Moss	Y	F, S	North [3]		
Campylium polygamum			Y	B, F, S	All		
Campylium stellatum		Starry Campylium	Y	F	All		
Cladopodiella fluitans		Floating Bog Liverwort	Y	B, F, S	All [4]		
Climacium dendroides		Tree Moss	Y	S	All		
Dicranum fuscescens		Broom Moss		S	All		
Dicranum polysetum		Wavy Moss		S	All		
Dicranum undulatum		Also called Wavy Moss	Y	B, F, S	All		
Drepanocladus aduncus		A sickle or curved-branch moss	Y	F	All		
Hematocaulis vernicosus	*Drepanocladus vernicosus*	A sickle or curved-branch moss	Y	F	All		
Hylocomium splendens		Stair-Step Moss	Y	S	All		
Hypnum lindbergii		Clay Pigtail Moss		S	All		
Limprichtia revolvens	*Drepanocladus revolvens*	A sickle or curved-branch moss	Y	F	All		
Mnium marginatum		Edged Lantern Moss		M	All		
Paludella squarrosa		Tongue Moss	Y	F	All		
Plagiomnium medium		Common Leafy Moss	Y	S	All		
Plagiomnium cuspidatum		Woodsy Mnium		S	All		
Pleurozium schreberi		Schreber's Moss/Big Red Stem		S, B	All		
Polytrichum commune		Common Haircap Moss		B, F	All		
Polytrichum formosum				B, S	All		
Polytrichum strictum		Bog Haircap Moss	Y	B	All		
Ptilium crista-castrensis		Plume Moss		S	All		
Rhizomnium punctatum		Pointed Round Moss		S	All		
Rhizomnium pseudopunctatum		Felt Round Moss	Y	S, F	All		
Rhytidiadelphus triquetrus		Shaggy Moss, Electrified Cat's Tail Moss		S	All		
Riccia fluitans		Floating Slender Liverwort		M	All		
Ricciocarpos natans		Purple-Fringed Liverwort		M,S	All		
Scorpidium scorpoides		Scorpion's Tail	Y	F	All		
Sphagnum angustifolium		Poor Fen Moss	Y	B, F	All		
Sphagnum capillifolium	*S. nemoreum*	Small Red Peat Moss	Y	B, F	All		

Scientific Name	Synonyms	Common Name	Wetland Indicator	Wetland Type	OWES Area (South, North, All)	Non-native	Dominant/ Co-dominant
Sphagnum centrale		Central Peat Moss	Y	S, F	All		
Sphagnum fuscum		Common Brown Peat Moss	Y	B, F	All		
Sphagnum girgensohnii		Common Green Peat Moss	Y	S, F	All		
Sphagnum magellanicum		Midway Peat Moss	Y	B, F	All		
Sphagnum papillosum		Papillose Peat Moss	Y	F	All		
Sphagnum russowii		Wide-Tongued Peat Moss	Y	B, F	All		
Sphagnum squarrosum		Shaggy Peat Moss		S	All		
Sphagnum warnstorfi		Warnstorf's Peat Moss	Y	F,S	All		
Sphagnum wulfianum		Wulf's Peat Moss	Y	S	All		
Thamnobryum alleghaniensis				S	All		
Thuidium delicatulum		Common Fern Moss		S	All		
Tomenthypnum nitens		Fuzzy Brown Moss	Y	F, S	All		

1. Some publications refer to circumpolar Arctic distribution
2. Listed in: Flora, Fauna, Earth, and Sky...The Natural History of the Northwoods (http://www.rook.org/earl/bwca/nature/index.html)
3. Species found in the more northerly counties of Minnesota, but not in the southern portion of the state (see: http://files.dnr.state.mn.us/natural_resources/plants/flm/mossatlas/county_checklists.pdf
4. Probably more common in northern Ontario, but may be found in conifer swamps in southern Ontario. Documented in Quebec at least as far south as Quebec City