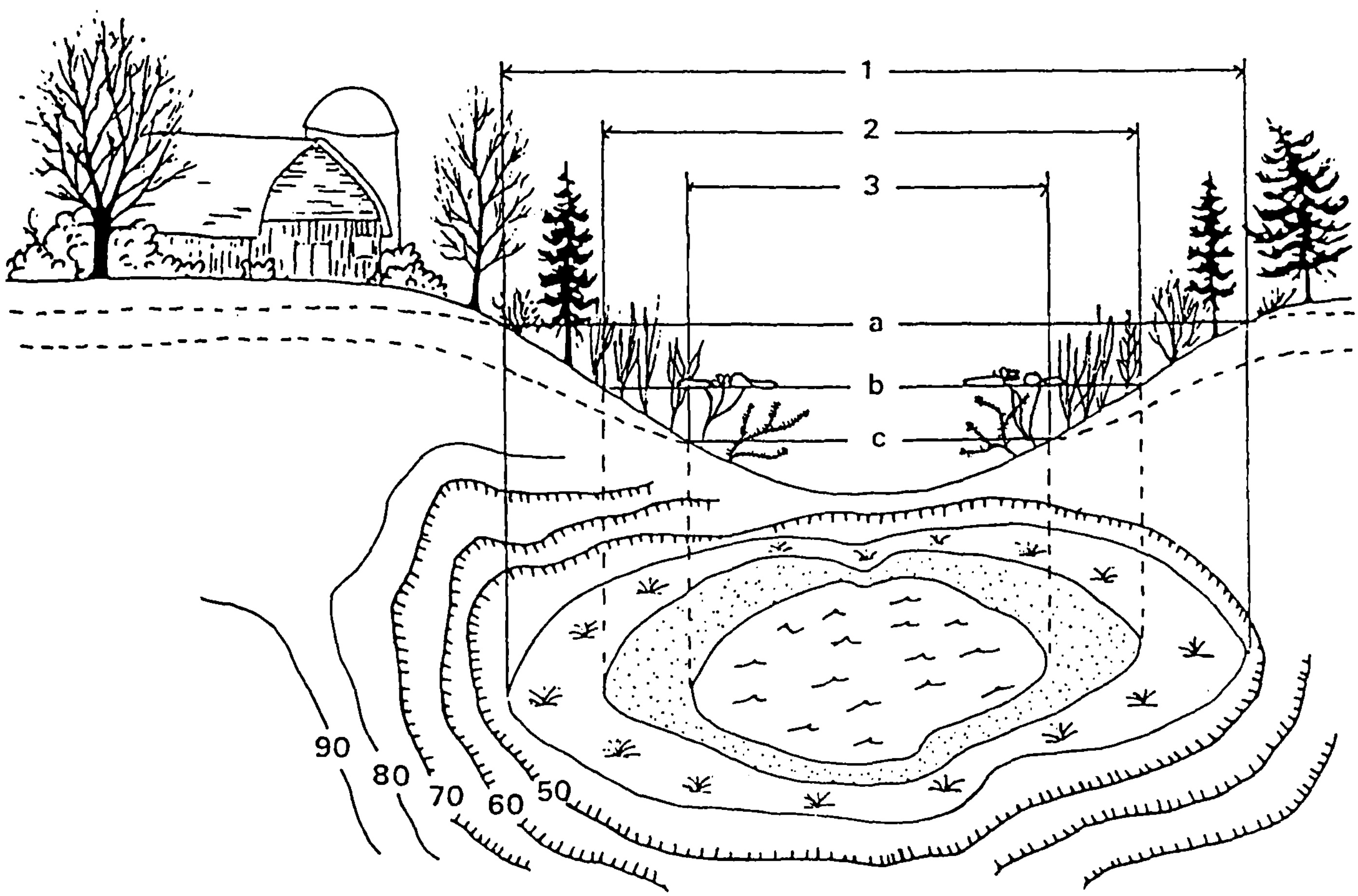
An Evaluation System for Wetlands of Ontario

South of the Precambrian Shield

SECOND EDITION



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Ministry of Natural Resources

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AN EVALUATION SYSTEM

FOR

WETLANDS OF ONTARIO

SOUTH OF THE PRECAMBRIAN SHIELD

SECOND EDITION

WILDLIFE BRANCH

OUTDOOR RECREATION GROUP

ONTARIO MINISTRY OF NATURAL RESOURCES

AND

CANADIAN WILDLIFE SERVICE, ONTARIO REGION

ENVIRONMENTAL CONSERVATION SERVICE

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PREFACE

Active work to create this system of wetland evaluation was started in 1980 by the Wildlife Branch, MNR and the Canadian Wildlife Service, Ontario Region, through the establishment of the Canada/Ontario Steering Committee on Wetland Evaluation with Dr. David Euler as its Chairperson. Fortunately, considerable background work on wetland evaluation was already available for review and possible application to southern Ontario. Many scientists, staff in government agencies, some economists, consulting companies, conservation organizations, and others have worked over the years to better define those wetland characteristics that contribute to the positive values of wetlands (Jeglum et al. 1974, Canada Land Inventory 1976, Golet 1976, Larson 1976, Gupta et al. 1976, Cowardin et al. 1979, Reid et al. 1980, Thibodeau and Ostro 1981, and others). This evaluation has borrowed freely from these sources.

In early 1981 a contract was awarded to Ecologistics Limited of Kitchener, Ontario, to prepare a report entitled "A Wetland Evaluation System for Southern Ontario". This report reviewed all existing systems of wetland evaluation as well as related wetland information applicable to southern Ontario and proposed a wetland evaluation model for areas of the province south of the Precambrian Shield.

During the summer of 1981, field testing of the system was carried out on 45 different wetlands in several parts of Ontario by between 15 and 20 different people including the Halton and Kawartha Regions Conservation Authorities.

In September 1981, Dr. Ted Mosquin was hired to consider and review the results of the field testing, to conduct additional field testing and to re-draft the document in light of reviews and discussions. As the Steering Committee deemed that substantial changes were necessary, re-writing, editing and reviewing of the new draft continued throughout the winter of 1981-82 and included several meetings of the Steering Committee.

The Hydrological Component of the evaluation was difficult to develop; therefore a hydrologist was contracted to work with the Committee to help develop the system. In March 1982, five outside experts in the field of hydrology were asked to review the hydrological component. The resulting responses of hydrologists had a major bearing on re-focussing the hydrological component and consequently this component develops an approach to the evaluation that is not found in the hydrological literature.

A draft of the evaluation system was published in May 1982 and a vigorous field testing program began. A total of 110 wetlands, scattered across southern and eastern Ontario were evaluated by 19 groups and/or individuals. The main participants included several Conservation Authorities, the Wildlife Branch, MNR and the Canadian Wildlife Service (Ontario Region). Of the 110 wetlands, 11 were independently evaluated 3 times, 22 twice and 80 one time. Selection of wetlands to evaluate was not at random; rather some were specifically selected to serve as "standards" or "benchmarks" and for these, replications by independent groups were obtained. Information relating to any and all problems associated with the application of the draft evaluation was obtained from nearly all groups.

As part of the process of review during the summer of 1982, six "outside experts" at universities, agricultural and forestry agencies conducted professional academic reviews of the draft system.

In October and November 1982, an analysis of variance of results obtained on all replicated wetlands was carried out by the Biometrics Division, Canadian Wildlife Service. As well, a report with recommended changes was prepared by Dr. Mosquin, the project's co-ordinator. In December 1982, the Steering Committee held a workshop, reviewed all studies, reports and reviews and made final decisions on all aspects of the evaluation. The "First Edition" was thus the result of a decision making process that involved contributions from dozens of people and numerous organizations coupled with repeated field testing of earlier drafts, over a 2 year period.

Since the "First Edition" (1983) was substantially different from the previous draft system, it was felt that the system should be subjected to further field testing, including replication of evaluations. Results of these replicated evaluations were analyzed statistically.

The current "Second Edition" incorporates some minor revisions and re-organization resulting from the experiences of various field teams from MNR, Conservation Authority and CWS offices following the 1983 field testing. The "Second Edition", however, is not different in scoring or in procedure in any substantial way from the "First Edition". In addition it incorporates relevant botanical information derived from the Ontario Geological Survey's Specifications for the Peatland Inventory Project.

ACKNOWLEDGEMENTS

Development of this evaluation system involved many people over more than 36 months of active work. David Cressman and Al Sandilands from Ecologists Limited, Kitchener were instrumental in developing a first draft system. In subsequent months, numerous meetings and field tests were completed to improve the system. Several people helped with the field testing, including: Beverley Booth, Brenda Brobst, Debra Chamberlain, Mike Eckersley, Geza Gaspardy, Duncan Gow, Dave Lemon, Ian Macnab, Lynda Maltby, Tim Mathers, Louis L'Arrivée, Jan McDonnell, Larry Roszell and Nancy Tilt. Lynda Maltby assisted with the final editing. Brian Collins performed statistical analyses on pilot studies of the system. Producing the document on a word processor was the work of Sharon Bradford who patiently incorporated the seemingly endless changes into the evaluation system.

The Committee is very grateful to those who reviewed the system and offered many helpful suggestions. These included: Paul Attack, Robert Edmondson, Phillip Hansen, Douglas Hoffman, William James, Carey Moore, Daniel Nixey, Alan Perck, Mark Robinson, Derek Smith, Charles Tarnocai, Harold Reinthaler, Milton Weller, Thomas Wilkinson, and Steven Zoltai.

Ted Gadawski of Ducks Unlimited met with the Committee several times and helped bring a practical point of view to our work. Nancy Patterson and Ron Reid of the Federation of Ontario Naturalists provided helpful criticism and were instrumental in developing basic work from which this evaluation borrowed extensively. John Riley of the Ontario Geological Survey provided valuable botanical background material from his peatland evaluation methods and Jan McDonnell provided additional background material on vegetation description.

Ted Mosquin worked long and diligently developing ideas, co-ordinating the field testing and writing numerous draft documents. His hard work and dedication are especially appreciated.

Members of the Steering Committee worked exceptionally hard in developing the final document. Gary McCullough spent numerous days in the field, testing earlier versions of the system and assisting with the final editing. Elizabeth Snell provided careful background documentation and comments about the system. Val Glooschenko contributed to discussions and the field testing. A planner's perspective was added to the document by Ron Spurr. Joe Carreiro's energy, drive and enthusiasm were invaluable in ensuring that the project received logistical support. As well, his knowledge of wetland phenomena contributed substantially to the structure of the evaluation system.

The support of senior management and particularly Doug Hagan and J. Douglas Roseborough of the Wildlife Branch, Ministry of Natural Resources and of the Canadian Wildlife Service, Environment Canada, is gratefully acknowledged. Eleanor Bottomley's hard work and superb touch in editing the "Second Edition" has improved it substantially. The Committee is pleased to thank her for a job well-done.

David Euler, Chairperson
Canada/Ontario Steering Committee
on Wetland Evaluation

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In this evaluation wetlands are defined as lands that are seasonally or permanently covered by shallow water as well as lands where the water table is close to or at 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. It should be clearly understood that lands under active agricultural uses that are periodically "soaked" or "wet" are not considered to be wetlands in this evaluation. Such lands, whether or not they were wetlands at one time are considered to have been converted to alternate uses and they cannot be evaluated through the application of this evaluation system.

INTRODUCTION TO THE EVALUATION SYSTEM

Wetlands are land types that are commonly referred to as swamps, fens, mires, marshes, bogs, sloughs and peatlands. They occur intermittently across the landscape of southern Ontario along lakes, rivers, streams and in headwater areas. They vary in size from a fraction of a hectare to many thousands of hectares. They may be relatively simple or highly complex and diverse.

This system of evaluation was created for the purpose of measuring wetland values. Its application is calculated to reveal not only which wetlands in an area, a region, or in southern Ontario as a whole are more valuable but also why one wetland is more valuable than another. It is intended to be used as a tool or instrument at various levels in Ontario's planning process. The ultimate aim is to be able to rate wetlands with regard to their relative value so that people who make decisions about land-use will have a means through which to ascertain which wetlands are the more valuable.

The need or "justification" for the development of this system of evaluation for Ontario's wetlands derives from several considerations. The greatest need stems from the fact that virtually no work has been done to quantify wetland values in a manner which permits comparison of wetlands in order to make knowledgeable land use decisions. Another consideration derives from an increased scientific understanding of the role that many wetlands play in maintaining wildlife populations, regulating stream flow and in pollution abatement. Wetlands are truly unique areas where land and water come together, providing habitat for a diverse variety of wildlife species that can live nowhere else. Many people see wetlands as having special and unique recreational, educational and scientific value to themselves and to society as a whole. Yet, until now no mechanism has existed to identify which wetlands in a given area or region are the most important to society as a whole. This system of evaluation should meet this need.

It is not the role of this evaluation to make suggestions on potential uses of wetlands. In many cases, however, the potential uses are <u>clearly implied</u> by the evaluation for each component obtained through the application of the system.

Since this evaluation system was designed to identify and measure some of the most important values of wetlands in an unbiased manner, it should provide a fairly accurate mechanism or framework through which conflicting claims about wetland values and uses can be resolved. By applying this system, knowledge of the different kinds of wetland values would become available for examination and assessment by any interested person, agency or group. Judgements about the best possible use of any wetland could then be made on the basis of relatively firm information. If insufficient information about the values of a particular wetland still exist, more could be obtained by individuals or groups. Decisions about future uses of a wetland could thus have a more rational basis.

The evaluation system can be applied to all Ontario wetlands south of the Canadian Shield. It should also be applicable to those wetlands in a band extending roughly between Haliburton and Leeds counties where significant calcareous drift overtops the Shield.

Implementation of the Evaluation System may take place at three levels.

(a) by a municipality, regional government or county as part of the Municipal Planning Process where often there is need for a mechanism to obtain some objective insights or knowledge into the value of a particular wetland in relation to other nearby wetlands;

(b) by Conservation Authorities as part of an overall watershed management plan, or by MNR Districts in relation to the need to develop wildlife and other resource management objectives or because of a need to contribute professional advice about wetlands to the development of Municipal Plans; and

(c) by the province as an aid to broad Land Use Planning. In this regard a wetlands evaluation system could serve as an essential cornerstone of a wetlands policy where there is need for an objective mechanism to identify the most valuable wetlands in the province. As well, the evaluation system may prove of value in identifying provincially or nationally important wetland habitat for migratory birds.

This evaluation system should therefore have both a short and a long term practical application and use to the people of Ontario.

Expertise Required to Implement the System

The Canada/Ontario Steering Committee on Wetland Evaluation recommends that the application of this system be assigned only to people or groups having the following "minimum expertise":

(a) knowledge of flora to the extent of being able to identify common species of wetland and upland plants, at least to the generic level;
(b) knowledge of air photo interpretation, sufficient to interpret wetland vegetation and boundaries; and
(c) general knowledge of wildlife.

As well, a minimum of 2 weeks of field training with a person or persons familiar with application of the system is recommended.

Rationale for Wetland Values

First and foremost, a system of evaluation for wetlands must be concerned with wetland values - their accurate definition, identification, measurement and ultimately, their evaluation. A wetland value derives from some attribute, feature, characteristic, activity, expression or function of a wetland that has a demonstrable worth to some segment of society, i.e. to wildlifers, recreationists, educators, scientists, local residents, the "public at large" and to others. Some obvious examples of wetland values centre around wildlife habitat and recreation. Other wetland values, as for example, those concerning hydrology are less obvious but none the less, very real.

This system of evaluation aims at identifying and deriving wetland values from basic information or facts about each wetland. Wetland facts are considered to be worth collecting if they provide useful information on the relative value of wetlands.

Four other considerations helped to limit the kind of facts or information about a wetland that should or should not be identified for measurement. These considerations taken together, further reduce the amount of information that is to be collected or measured. The four are:

(1) securing the needed information did not require time-consuming scientific research;

(2) needed information could be obtained by qualified individuals with a minimum training period;

(3) information related to each wetland value could be meaningfully graduated into a scale of numbers ranging from little or no value to full value; and

(4) in developing the evaluation system many professionals in the fields of biology, agriculture, and hydrology were consulted, thus eliminating dubious or controversial values.

The evaluation 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. Generally speaking for the more settled areas of Ontario high scores mean high values.

This evaluation aims at neither implying nor advocating the development or the protection of wetlands. Therefore, it does not evaluate vulnerability of wetlands to various sorts of developments and pressures. There is, of course, no question that many wetlands are much more vulnerable to conversion to alternate uses than others. It is marketplace forces together with political and planning processes in society and in government that determine the uses to which wetlands are developed or allocated. The assessment of vulnerability is therefore considered to be presumptive and outside the scope of this evaluation. It would also be difficult to evaluate vulnerability without introducing bias into the evaluation process.

Likewise, the need for various kinds of wetland management cannot be evaluated because it is not the role of this evaluation to make suggestions on potential uses of wetlands. In many cases, the potential uses are implied by the total points for each component obtained through the application of the system. It is these total points, and more important, the combinations of total points of the components that may suggest the best possible uses to which a wetland could be put or allocated through the planning process. Another reason for avoiding the evaluation of management potential is that it is presumptive to draw conclusions about management from a one or two day visit to a wetland by a person or team not trained in the resource management field.

It is worth re-emphasizing that the values which humans ascribe to wetlands are many and varied with respect to their fundamental nature. Thus a value may derive from any one of the following sorts of things, namely, a feature, an expression, a degree of activity, an amount, a distance, a rhythm, a timing, and so on. While the exact nature of each value is to different degrees implicit in the value itself, the rationale for adopting certain values shall be presented in turn to ensure that the basic reasons for selecting and weighting the values in relation to others within each subcomponent are as clear as possible.

Structure of the Evaluation

In this evaluation, wetland values are grouped into four separate components. These are Biological, Social, Hydrological and Special Features. Each component is evaluated individually and separately from the others. The Biological, Social and Hydrological components may each generate a total of 250 points. The Special Features component may generate extremely high scores (i.e. in excess of 1,000) but the likelihood of such high scores is extremely low.

With 250 possible points for each component one can develop a more sensitive point spread within "subcomponents" than if a lower maximum number had been chosen. The adoption of the high maximum total also permits "minor" values (ones to which only few points are allotted) to be more accurately included in the evaluation.

Within each component, subcomponent values have been weighted to reflect their importance relative to each other. Some values are widely considered to be of major importance, as for example breeding habitat for an endangered species and many points (250) are allotted this variable. At the other end of the scale are "minor" values given only a few points. This evaluation takes the position that even "very minor" wetland values should be evaluated and included in the overall assessment because the evaluation seeks to be comprehensive. To avoid the measurement of known values (assuming, of course, that the information is practicable to collect) would appear to be contrary to the need to optimize accuracy.

In no case was the number value that was assigned to a variable arrived at lightly. The weighted values are the end product of a process involving numerous reviews and adjustments over a 2 year period made under the guidance of the Canada/Ontario Steering Committee on Wetland Evaluation. There was much field testing, consultation with outside "experts", and considerable deliberation. Thus, experience and calculated judgement about the relative importance of the accepted variables is the basis for the credibility of the numbers.

Concepts and Definitions

Anyone intending to apply this evaluation to wetlands should first become familiar with the overall structure and purpose of the evaluation, with the definition of a wetland and with the concept of wetland area.

Wetlands - In this evaluation wetlands are defined as lands that are seasonally or permanently covered by shallow water as well as lands where the water table is close to or at 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. It should be clearly understood that lands under active agricultural uses that are periodically "soaked" or "wet" are not considered to be wetlands in this evaluation. Such lands, whether or not they were wetlands at one time are considered to have been converted to alternate uses and they cannot be evaluated through the application of this evaluation system.

Wetland area - Among the most important concepts is that of the wetland area. Thus, the term wetland is a general one and includes specific land types commonly known as marshes, bogs, swamps and fens, etc. Within a single wetland area you may find radically different ecological circumstances as for example anopen water marsh, a spring fed swamp forest, an open channel of river, the open water edge of a lake, and so on. 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. The concept of wetland area as defined above has been adopted because this approximates the concept of a wetland widely held in the public mind.

Wetland complex - The concept of area of a wetland complex is an expansion of the above concept of a single contiguous wetland. In a wetland complex major functional discontinuities (such as uplands) may subdivide the area into a number of distinct wetland units, but the entire complex is evaluated as a single unit. Wetland complexes are further considered below (See (viii) Wetland Size and Boundaries).

In no case can a wetland be evaluated accurately without one or more visits to the site. For very large wetlands several days of field work may be required to obtain an accurate evaluation.

The most efficient and cost effective way to approach the evaluation of wetlands is to concentrate one's attention on wetlands in a given drainage basin or sub-basin. This approach is most productive because wetlands in the basin are often functionally associated. Also, there would be a minimum of duplicated effort in securing necessary information both from published sources and from interviews with resource officials or residents in the area. As well, numerous wetlands can be visited during essential field trips.

Sources of Information

The general approach in the initial information gathering stage should involve personal contacts and studies of literature from as many sources as possible. Many of the questions in the Wetland Data Record should be answered prior to field work. This element of the work is very important and adequate time should be allotted for its completion. Contact with appropriate organizations and agencies, outlined below and in Appendix I, is vital to the credibility of the evaluation and of the Special Features component in particular.

Since wetlands differ widely with regard to the amount and kind of available knowledge, one does not have to answer the questions in any particular sequence. However, at the minimum, the first 7 questions in the Wetland Data Record should be answered prior to field work. Many other questions can be tentatively answered and some of these can then be doubled-checked in the field. As well, preliminary maps can be drawn particularly for larger wetlands.

One of the best ways to ascertain the exact locations of wetlands within a study area is through a scrutiny of the following:

1) air photos
2) National Topographic Series (N.T.S.) maps
3) Wetland Mapping Series 2nd Approximation
4) Forest Resources Inventory Maps
5) Watershed Map, possibly available from the Conservation Authority.

Appendix II lists maps and addresses for obtaining maps and air photos.

Among the more useful maps to consult are the N.T.S. maps. In the N.T.S. maps, some sheets are not as comprehensive as others. Numerous wetlands smaller than about 5 or 10 hectares are not shown and, in some parts of Ontario, many of the designated wetlands have since been drained and converted to agricultural or other uses. The Wetland Mapping Series Second Approximation is not 100 percent accurate, and may not be ground-truthed for a specific wetland. Field checking may be necessary to determine the presence of wetlands and their boundaries. Forest Resources Inventory Maps may also provide useful reference.

The Ministry of Natural Resources may have information on fish and wildlife, timber, recreation, Environmentally Sensitive Areas (ESA), International Biological Program (IBP) sites, hunting, fishing and trapping. Conservation Authorities are another important potential source of information. Authority files may contain data on fish and wildlife, vegetation, water quality, flow stabilization purposes and general watershed information, Environmentally Sensitive Areas, hazard lands, flood lines, recreation and resource and land use. The Ontario Ministry of Agriculture and Food (OMAF) will have information on county soils. Certain other provincial government agencies also may have valuable information: Ministry of the Environment (MOE) for water quality and quantity data for lakes and streams; Ministry of Culture and Recreation for Ontario Recreation Survey data.

Other sources of biological and general wetlands information include:

1. Canadian Wildlife Service
2. Ducks Unlimited
3. Naturalist clubs may have tabulated lists of flora and fauna associated with certain wetlands (see Appendix I)
4. Ontario Breeding Bird Atlas contacts
5. Residents and sportsmen may be able to provide information on sport and game species and on recreational use of the wetland
6. Municipalities are sources of information on official plans, zoning, pending development proposals and ownership.

When considerable information has been obtained prior to field work an overall impression of what one expects to encounter at the site is achieved. Therefore field efforts can concentrate on critical topics and in key areas of the wetland.

Access to reports and files containing relevant information should be arranged by telephone in advance of the date when one anticipates reviewing such information.

It is absolutely necessary to provide accurate and complete references for sources of printed information. Personal communications should be documented as to the date, name and title of the person communicating information cited.

It is often advantageous to determine from government personnel or others who are familiar with the wetland the most efficient way to travel to the wetland and to gain access into it.

If key local residents, sportsmen or naturalists who can provide information on the wetland can be identified in advance of the field trip this may reduce your work to a single visit. Arrangements for access to a property should be made prior to the field trip.

Below is a list of equipment which should be available to each field crew for use where and when required.

EQUIPMENT

canoe
cartop canoe rack
paddles
anchor and rope
life jackets
waders, rubber boots
water depth measuring device
metre stick
conductivity meter and associated equipment
thermometer
binoculars
camera (polaroid and/or 35 mm)
plant press
compass
clip boards
paper, pencil, field notebook
topo maps
air photos & wax pencils (or acetate overlay and fine-tipped markers)
stereoscopic glasses
field guides and manuals
copy of Evaluation System-procedures and data records

OTHER

plastic bags
jackknife
water cooler
first aid kit
knapsack
rain gear
sun hats
insect repellent
ethanol (for cleaning air photos)

A list of field guides and manuals that each evaluation team may require is presented in Appendix III. Most would more often be used as references and would stay in the field vehicle or the office.

In summary, some of the data record should be completed prior to field investigations. Site visits must be made to:

1) make notes on vegetation forms,
2) check on preliminary interpretations of photos and maps,
3) ascertain directions of drainage,
4) check the quality and authenticity of existing data,
5) watch for rare species (bird, plant, etc.),
6) detect signs of presence of furbearers, snappers, bullfrogs, timber, wild rice,
7) determine wetland boundaries,
8) obtain conductivity readings,
9) determine dominant influence for transitional areas, i.e. if wetland type is transitional between bog and swamp, decide which influence predominates,
10) note general weather conditions for the day (and season in general, i.e. dry, cool, etc.),

11) note population of nearest town (greater or less than 10,000) and distance from wetland.

A clear understanding of what is to be accomplished at each site should be established before going to the field.

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 a minimum of one visit will be essential during the summertime or early fall to obtain data on the extent and nature of submergent and floating vegetation as well as the nutrient status of the water. All Palustrine wetlands (see 1.1.4 below) will have to be visited during the low water stage to determine surface inflow and outflow. Wetland complexes may be very large and therefore require several or more visits in order that accurate information be the basis of the evaluation. Specific wetlands not only differ with regard to the amount of available information but they can also be so dynamic, so dependent upon exigencies of seasonal rainfall, etc. and in some cases, so complex, that the evaluation team will need to exercise considered judgement in determining both the timing and the date(s) of field visits. The aim in all cases is to ensure that the Wetland Data Record is as accurate, objective and complete as possible so that, in so far as is practicable, the conclusions drawn in the evaluation will in fact withstand scrutiny and the test of time. The evaluation is conducted at a point in time, and the present conditions are assessed. Where information is not available, this should be noted; the data record should be updated as information becomes available, making certain that all files where wetland data is stored are simultaneously updated also.

COMPLETING THE WETLAND DATA RECORD

(i) WETLAND NAME AND/OR NUMBER

Many wetlands have map or local names and these should be entered if known.

(ii) ADMINISTRATIVE REGION AND DISTRICT OF THE MINISTRY OF NATURAL RESOURCES

Enter name of both the region and the district of the MNR. This information is available at MNR offices or from map No. 5 of Appendix II.

(iii) CONSERVATION AUTHORITY JURISDICTION

Indicate the name of the Conservation Authority under whose jurisdiction the wetland falls. If the wetland straddles the border of two Conservation Authority jurisdictions then enter the names of both.

(iv) COUNTY OR REGIONAL MUNICIPALITY

Enter the name of the county or regional municipality in which the wetland is located. If the wetland straddles the boundaries of two counties, then enter the names of both.

(v) TOWNSHIP

Enter the name of the one or more townships in which the wetland is situated.

(vi) LOTS AND CONCESSIONS

Enter the Lots and the Concessions in which the wetland is situated. This information can be most readily obtained from county or municipal maps. However, it can also be obtained from reading the Roman Numerals (Concessions) and corresponding numbers (Lots) from the N.T.S.1:50,000 maps or 1:25,000 if available. If the wetland is very large and covers more than 10 lots, enter only those at the edges of the wetland that in your view will suffice to enable people who use Lots and Concessions to locate the wetland readily.

(vii) MAP AND AIR PHOTO REFERENCES

(a) Longitude and Latitude: Obtain from the National Topographic Series 1:50,000 or 1:25,000 scale maps. The investigator should enter the area of the approximate centre of the wetland or wetland complex to the nearest minute.

(b) U.T.M. Grid Reference: This grid, part of a widely accepted world-wide system, provides a method to give a map reference to the nearest 100 metres. "U.T.M. Zones" run north and south between lines of longitude. Southern Ontario contains two numbered zones, 17 and 18, each 6o wide. The line separating the two zones follows the 78th line of longitude with 18 being to the west and 17 to the east of the line. Within each zone a metric mercator grid is defined in a way that enables you to describe the geographical location of any wetland by referring to its position in terms of a single point. To adequately comprehend the U.T.M. System a copy of the booklet entitled "The Ontario Geographical Referencing Grid" (The Universal Transverse Mercator Grid System) available from the Ontario Ministry of Natural Resources is essential reading for all field workers. All National Topographic Series Maps at scale 1:25,000 and 1:50,000 indicate the U.T.M. Grid in 4 km or 1 km blue squares respectively. The north-south lines of the grid are termed "northing" and the east-west are termed "easting". To determine the easting position, read the number on the grid line immediately to the left of the point you wish to reference. Then estimate tenths of a square from this line eastward to the point. To establish the northing position, read the number on the grid line immediately below the point. Then estimate tenths of a square from this line northward to the point. For points at the latitude and longitude of southern Ontario, you will end up with a six digit number (assuming that you are reading the point to the nearest 100 metres).

Since a wetland location is being described by fixing the approximate areal centre of the wetland, wetlands straddling the 78th line of longitude (i.e. between zones 17 and 18) readily fall into one zone or the other. In the unlikely event that the centre of the wetland is located exactly on the 78th line of longitude, its location will be accurately described by either one of the two zones.

(c) <u>National Topographic Series Scale and Map Numbers:</u> Each map sheet of the N.T.S.contains an index number which enables one to identify adjoining maps readily. This number (e.g. 31G/10 should be entered, or 31G/10h at the scale 1:25,000).

(d) <u>Air Photos</u>: Enter the date, scale, flight number and plate number of the air photos you are using. These are noted on the photos themselves. Use the most recent air photos (dated 1978) at scale 1:10,000 if available.

(viii) <u>WETLAND SIZE AND BOUNDARIES</u>

(a) <u>Wetland Boundaries</u>:

One of the most important tasks in the entire evaluation system is the accurate determination of wetland size. Therefore, it is imperative that boundaries of each wetland be accurately located and drawn. Each evaluator or evaluation team must appreciate fully both the criteria which are used to delimit wetlands from non-wetlands and also the methods of mapping and measurement. When uncertainties are encountered, the boundary criteria should be applied with great care so that decisions made can always be justified and defended. This means that often, time simply must be allocated to visit portions of a wetland where uncertainties about boundary lines exist. Wetland evaluators must be willing to spend several hours to several days (in the case of large or isolated wetlands) satisfying themselves that boundary lines have been accurately recorded on the map. There are many types of wetland boundary problems where different criteria must be employed to determine the most effective and practical boundary in each case. Needless risk during field work should be avoided, and adequate safety precautions during field work are essential. In cases where hazards (especially isolation, mires, etc.) exist evaluators should explore the wetland in groups of 2 or 3.

The outer boundary of a wetland, delimiting size, is the one which will be used in several key correlations in the evaluation. However, several internal boundary lines must also be drawn although the degree of accuracy is not as critical. It is during the field work that the basis for drawing these internal boundaries is decided. Internal boundaries are those between the 4 wetland types (see 1.1.3), between dominant vegetation forms (see 1.2.5) and between the wetland as a whole and that portion of the wetland containing emergents and/or submergents (see 3.3.1.2). Criteria for establishing internal boundaries are explained in the appropriate subsections of the Biological Component.

The evaluation team will find that often wetland boundaries are relatively abrupt, while in other areas boundary lines will have to be drawn across a zone of gradual ecological change. The main types of boundary problems that one will encounter are discussed below together with corresponding guidelines on how to establish the most effective boundary line or lines in each case.

(b) Use of Soils Maps:

Soils maps have often been used to indicate wetland boundaries. When a hydrological regime in an area is conducive to the formation of a wetland, a characteristic wetland soil develops. However, because soils maps are generalized and of a small scale, they have very limited value in helping to establish precise wetland boundary lines. The activities of man may have had profound impacts on reducing, altering, or expanding wetland areas through drainage, clearing, dredging, dams, cultivation, etc. The soils boundary line should only be used in absence of better information. Soils may fairly accurately suggest the upland boundaries of only those wetlands that have not been drained or converted to other uses and where the "original" hydrological regime remains more or less intact. So, in summary, in no case should one consider the boundaries as indicated on soils maps to be definitive; soils information should only be used as a general guide to the location of wetland boundary lines.

(c) Wetland Edges Bordering on Deep Water Lakes and Rivers:

Many wetlands border on lakes, rivers, streams and reservoirs. The deep water boundary of such wetlands should be drawn at the 2 metre depth of the seasonally low water level regardless of the presence or absence of submergent vegetation. Some special situations or exceptions to the above rule are as follows:

(1) open water areas on the lake side of a barrier beach are not considered to be wetlands (barrier beach is included as part of wetland except where vegetation is strictly upland species);
(2) non-vegetated embayments or ponds which border on or are more or less surrounded by wetland vegetation should be considered as part of the wetland except if such areas are true lakes (greater than 8 ha and deeper than 2 m);
(3) mudflats or sandy "beaches" that are not separated from the wetland by a barrier beach are to be included in the wetland.

(d) Wetland Edges Bordering on Agricultural Fields, Pasture or Urban Development where a Portion of the Wetland is being drained or has been Converted to Alternate Uses:

As a rule, wetland areas effectively converted to other uses through clearing, draining, dredging, etc. should not be considered as wetlands unless the area is no longer serving its alternate use function -- as for example, abandoned farmland. In the event that the former wetland has been effectively drained, wetland vegetation has vanished, and a new smaller wetland remains, it is the latter which should be used to establish wetland size. In those areas where the recent construction of drains is causing the wetland vegetation to vanish and be gradually replaced by upland species, wetland boundaries should be drawn at the edge of known wetland species. About 25% of the area should have wetland plant species to be included as wetland.

(e) Wetlands Bordering on Upland Forest:

A large number of Ontario's wetlands have a forested boundary where the wetland grades either rapidly or very gradually into upland forest or pasture. The principal criterion for determining the boundary of such wetland areas will be the species composition of the plant community. It is absolutely essential that an evaluator be able to correctly distinguish wetland and upland species. Some plant species are excellent indicators of the permanent availability of water at or very near to the surface or the ground. Wetland species may also indicate the extent of the seasonally high water levels. The field worker will need to be able to recognize and accurately identify some key wetland species. Certain species, such as White Cedar, White Elm 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 wetland environments. The field worker should be able to identify at least the major upland species of trees and shrubs since this will greatly facilitate the rapid delineation of meaningful boundaries. Some examples of upland indicator species are Sugar Maple, White Birch, Hop-Hornbeam, Beech, and White Spruce; there are many others. If an area has these species present, then you are no longer in the wetland environment.

Appendix IV lists some of the wetland and upland species that one should be familiar with for accurately establishing wetland boundary lines.

(f) Limits of Wetlands that Follow Meandering Streams (or Shorelines):

Often a narrow band of wetland vegetation will be found along banks of a slow moving stream or river. Such wetlands offer both water and excellent "edge effect" for wildlife. The wetland may be more or less continuous for many kilometres. No consistent rule can be formulated to aid with establishing the upstream and downstream limits of such wetlands and the field worker will have to consider various sorts of discontinuities and discordancies such as steep banks, rapids, beaver dams, roads, property lines, presence of agricultural lands or even municipal or other jurisdictional boundaries to establish practicable limits.

(g) Boundaries of Wetlands that Occupy Seasonally Flooded Lands:

Many wetlands occur along rivers or streams on seasonally flooded lands. "Flood Risk Mapping" of river basins is often carried out by Conservation Authorities or other agencies to determine the boundaries of lands which may become periodically flooded or inundated. The risk of serious flooding once every 10 years is obviously greater than the risk of serious flooding every 100 years. It is therefore not possible to use flood risk mapping criteria as the basis for establishing wetland boundaries.

The species composition of the flora along with other factors outlined above should provide the most effective basis for establishing practicable wetland boundaries in seasonally flooded lands. A word of caution: on a hot, dry season in midsummer, a wetland may appear very "dry" indeed. Hence, it is essential to be able to identify key wetland indicator species.

(h) Beaver Flooded Areas:

In most instances beaver flooded areas are wetlands and should therefore be inventoried, provided of course that they meet the basic criteria of minimum size and the dominance of wetland vegetation.

However, where the flooding is causing damage to valuable farmland, roads, etc., 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 ephemeral in nature. Their existence depends upon availability of food supply, trapping pressures, the effectiveness of control programs, amount of precipitation and this means that water levels as well as the areal extent of flooding will vary from year to year and 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; in cases where the beaver dam is not functional then by the clear evidence of the recent presence of wetland species. In no case should flooded or recently flooded areas that contain upland forest species be included in the wetland unless there is clear evidence that the beaver dam may be "permanent" as for example in areas of abandoned farmland.

(i) Minimum Size:

What should constitute the minimum size of wetland that should be accepted by an evaluation team for scoring and for eventual evaluation? One half a hectare, two hectares or even ten hectares have often been suggested as the minimum size to qualify for inventory purposes. Many small wetlands (smaller than a hectare) are admittedly and demonstrably both interesting and productive of certain wildlife and other values. Minimum size will therefore be established as two hectares (5 acres). If there are obvious reasons why a wetland that is smaller than that should not be omitted from the inventory process, the evaluators should proceed to score them along with larger wetlands.

(j) Wetland Complexes:

Some areas of southern Ontario contain two or more closely associated wetlands which vary in size from a fraction of a hectare to several hundred hectares. The topography of the landscape in which those wetlands occur, the short distances between separated wetlands and the "density" of wetlands per unit of areal landscape may be so complex that delineation of the wetland units into individually recognized wetlands would not only be a time consuming task but one which could have questionable utility for planning purposes. At the same time such "wetland complexes" are commonly related in a functional way, that is, as a group they tend to have similar hydrological, biological and/or social functions and much of the wildlife in the area of the complex will be in part dependent on the presence of the entire "complex" of wetlands.

Whether or not the evaluation team should recognize a wetland complex may often require a subjective decision, as many of the considerations involved are often subjective in nature. Since wetland phenomena are so often continuous, when and where you delineate a complex should be a matter of discussion with fellow field workers, wildlife and other officials, etc. In all cases the evaluator's goal will be to delineate optimally practical and functional wetland units bearing in mind that this evaluation has been designed as an instrument for making land use planning decisions and not as an instrument for making scientific comparisons between wetlands.

Once a complex is recognized, it should be scored as a single unit.

To define a wetland complex, we suggest consideration of the following:

1) A wetland complex must be definable with respect to geography (lot, concession, township, county, province, etc.) or to physiography (riverine, flood plain, watershed or climatic zone).

2) The components of the complex should be basically the same site type (Lacustrine, Palustrine, Isolated, Riverine), or have a logical progression from one site type to the next.

3) The wetlands included in the complex should share several of the following characteristics:

   (i) wetlands within the complex (next nearest wetland) are within 0.75 km of each other

   (ii) wetlands have the same dominant type (Swamp, Bog, Fen, Marsh)

   (iii) wetlands are hydrologically connected by surface water

   (iv) wetlands have similar biological functions such as wildlife habitat (roosting cover, breeding or feeding areas)

   (v) wetlands have similar social functions (i.e. recreational or educational)

   (vi) wetlands have similar hydrological functions (ground water recharge, water quality improvement, water detention ability of complex has significantly greater ability than the individual wetlands)

   (vii) the wetlands, considered as a group, would facilitate land use planning decision-making.

An example will illustrate several features of a wetland complex. Figure 1 shows the Glanworth wetland complex south of London, Ontario, in which a number of small wetlands occur in close proximity on a landscape having few other wetlands. The wetland complex occurs in a headwater area (Palustrine site type), with some of the wetlands being hydrologically connected by surface water while others are not. The area is recognized as a complex because:

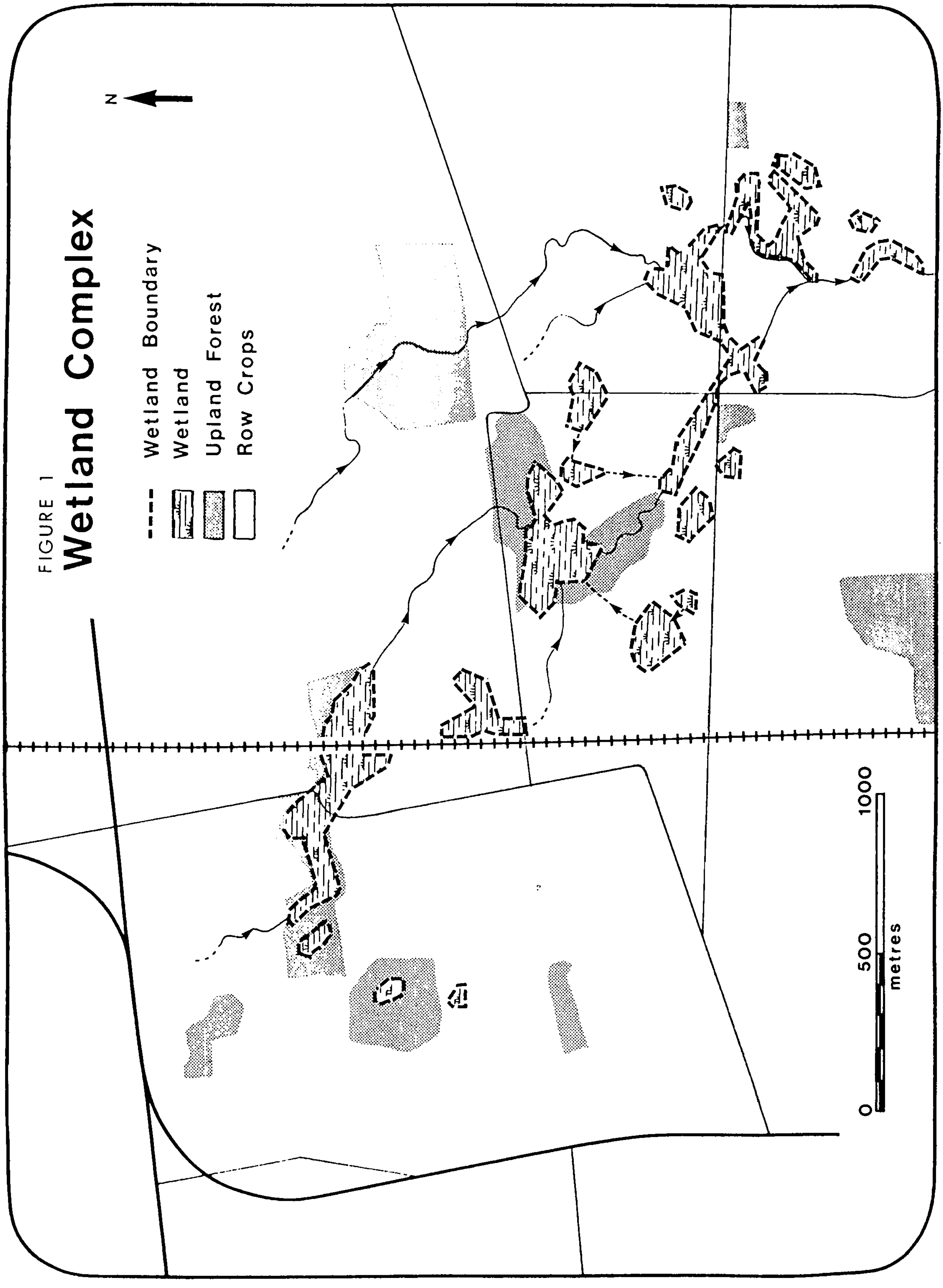


FIGURE 1
Wetland Complex

(i) wetlands within the complex are in close proximity

(ii) wetland type is approximately 84% forest Swamp, and the remainder (about 16%) is Marsh

(iii) all wetlands in the complex are Palustrine site type; most are connected hydrologically at least intermittently by surface water, with a few being isolated but closely situated

(iv) wetlands have similar or complementary biological function, particularly with respect to waterfowl. In this complex, the different wetland units with varying degrees of permanence of water and of vegetative cover, are able to satisfy the various needs of waterfowl for nesting sites, food, moulting cover, etc.

(v) wetland units share a similar social function in supporting moderate hunting and other activities on privately-owned lands

(vi) wetland units have similar hydrological function.

Note that areas of wetland less than 2 ha in size are included as part of the complex. Designation of a complex provides a means for evaluating a number of closely associated small wetlands (e.g. potholes) that otherwise would be overlooked for failing to meet the minimum size requirement for a wetland (2 ha). Depending on the number of individual wetlands within a complex, one may want to arbitrarily set a minimum size (for example, 0.5 ha) for inclusion of small wetland areas in the complex.

Determining boundaries delimiting a wetland complex may also be subjective. Some considerations are listed below:

a) hydrological circumstances, discontinuities

b) catchment basin may or <u>may not</u> be a determining factor, as the complex may extend over more than one watershed

c) functional discontinuities, e.g. social, biological

d) spatial distances, number of wetlands, area of landscape covered etc.

The circumstances creating a wetland complex will vary from area to area. The reasons for the grouping may be all important in allowing an assessment to be made within some sort of measurable boundaries. It may be that any group of wetlands may be considered as a complex; however, if one complex cannot be evaluated and compared against another, then there is strong argument for describing complexes only as a last resort.

(k) Preparation of the Wetland Map:

Once all wetland boundaries have been identified a base map (drawing) must be prepared. Appendix V offers some guidelines for the preparation of the map. Begin by making a preliminary drawing of the wetland using air photos and if necessary topographic maps. One may use the 1:10,000 air photos taken by the government of Ontario in 1978. Or, if available, any recently taken black and white or colour air photos may be used. Depending on the size and type of the wetland, considerable information might be traced from the photo. However, for wetlands smaller than about 100 hectares, one may need to prepare a larger scale drawing. Bear in mind that during and after the field work one will be entering a variety of information on the photos or map so the scale chosen should be able to accommodate the details of dominant vegetation forms, for example. In the field, one can compare the observed features of the wetland with air photos and mark appropriate boundary lines directly on the photos. Extrapolations which flow from original field observations are the essential basis for the final drawing.

(l) Determination of Size:

Once the drawing is complete and final, the size of the wetland can be measured. Great care should be taken to ensure that the scale reduction is accurately interpreted. To determine size, use a dot grid, planimeter or digitizer. If care is taken, accurate measurement of size can be made with any one of the three methods. Appendix VI offers some guidelines for proper measurements using the three methods. Bear in mind that in the case of larger wetlands use of the dot grid method is very time consuming. If a digitizer is not available a planimeter should be used. Note that one must also determine % area covered by each of the four wetland types and by open water, as well as the number of hectares dominated by emergents and/or submergents. Aim at determining size to at least 95% accuracy.

1.0. BIOLOGICAL COMPONENT

The biological component is evaluated under three major subcomponents, namely productivity, diversity and size. Productivity is evaluated by examining 5 interrelated values, namely growing degree-days, wetland soils, kind of wetland types, site, and nutrient status of surface water. Diversity is evaluated by studying 6 characteristics: number of wetland types, vegetation communities, diversity of surrounding habitat, proximity to other wetlands, interspersion and open water type. Size is evaluated by tying its value closely to wetland quality.

1.1. PRODUCTIVITY VALUES

Biological productivity provides a measure of the ability of a certain area to produce a crop of living organisms. Biological productivity may be either primary (if produced by chlorophyll-bearing organisms) or secondary or tertiary (if produced by non-chlorophyll bearing organisms). The form of "wetland energy" that is available to wildlife is that derived from primary productivity. Herbivorous wildlife (plant eaters: secondary productivity) consume this plant matter and are eventually themselves consumed by carnivorous wildlife (meat eaters: tertiary productivity). For this reason, primary production is a good indicator of the overall biological productivity; the more energy available, the more consumers the ecosystem can support. Because primary productivity provides a good general approximation of both secondary and tertiary productivity and because with certain exceptions (Section 4.2) the evaluation of secondary and tertiary productivity would be a complex and time-consuming matter, only primary productivity is measured in the Biological Component.

1.1.1. Growing Degree-Days

Broadly speaking, the greater the amount of organic material or "biomass" that a group of plants can produce, the more becomes available for the use of man and of all forms of life that depend directly or indirectly on plants for food. The single most important factor contributing to the production of biomass is temperature (Leith and Whittaker 1975, Edey 1977). Thus, in southern Ontario, most species of plants growing in their natural environment will produce more biomass at 15° Celsius than they would at 10°C. As well, in areas of Ontario where average daily temperature is higher and the frost free season is longer, a greater diversity of plant species can also be found. This means that, in general, more species of animals can be sustained by those wetland plant 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, Edey 1977) by recording the seasonal accumulation of "Growing Degree-Days" (GDDs) above 5.5°C. This base temperature is chosen for the index because in temperate climates plant growth essentially stops at lower temperatures.

The concept of growing degree-days assumes that plant growth is related directly to the average daily temperature. It ignores soil temperature, differences in the pattern of night and day temperature and other variations caused by the stage of growth. The degree-days for each day are added together, or accumulated, throughout the growing season (Edey 1977).

Thus we can say that the higher the number of GDDs the greater is the amount of biomass that plants in an area can produce by photosynthesis. Of course, other factors can severely influence the responses of various plant species in any particular wetland, for example, the availability of water, nutrients, light, water body morphology, rate of grazing or harvesting, nature of drainage, kinds of vegetation forms present, and so on. But as a general rule the direct correlation between GDDs and plant biomass production is a positive one.

The number of GDDs across the landscape of southern Ontario is known (Brown et al. 1968). This means that GDDs can be correlated with geographical position of each wetland and it is for this reason that the GDD index is considered to be a generally applicable attribute to wetland evaluation in the province. The map in Figure 2 shows the number of accumulated growing degree-days above 5.5 degrees Celsius (42°F.) in different parts of southern Ontario. The lowest means are found in more northern and interior upland regions while the highest are found on Pelee Island.

GDDs are determined from Figure 2. The answer should be expressed as a range in which a wetland occurs; no attempt should be made to guess an absolute number. If a wetland is located directly under a GDD isogram, the higher intervals should be recorded.

1.1.2. Soils

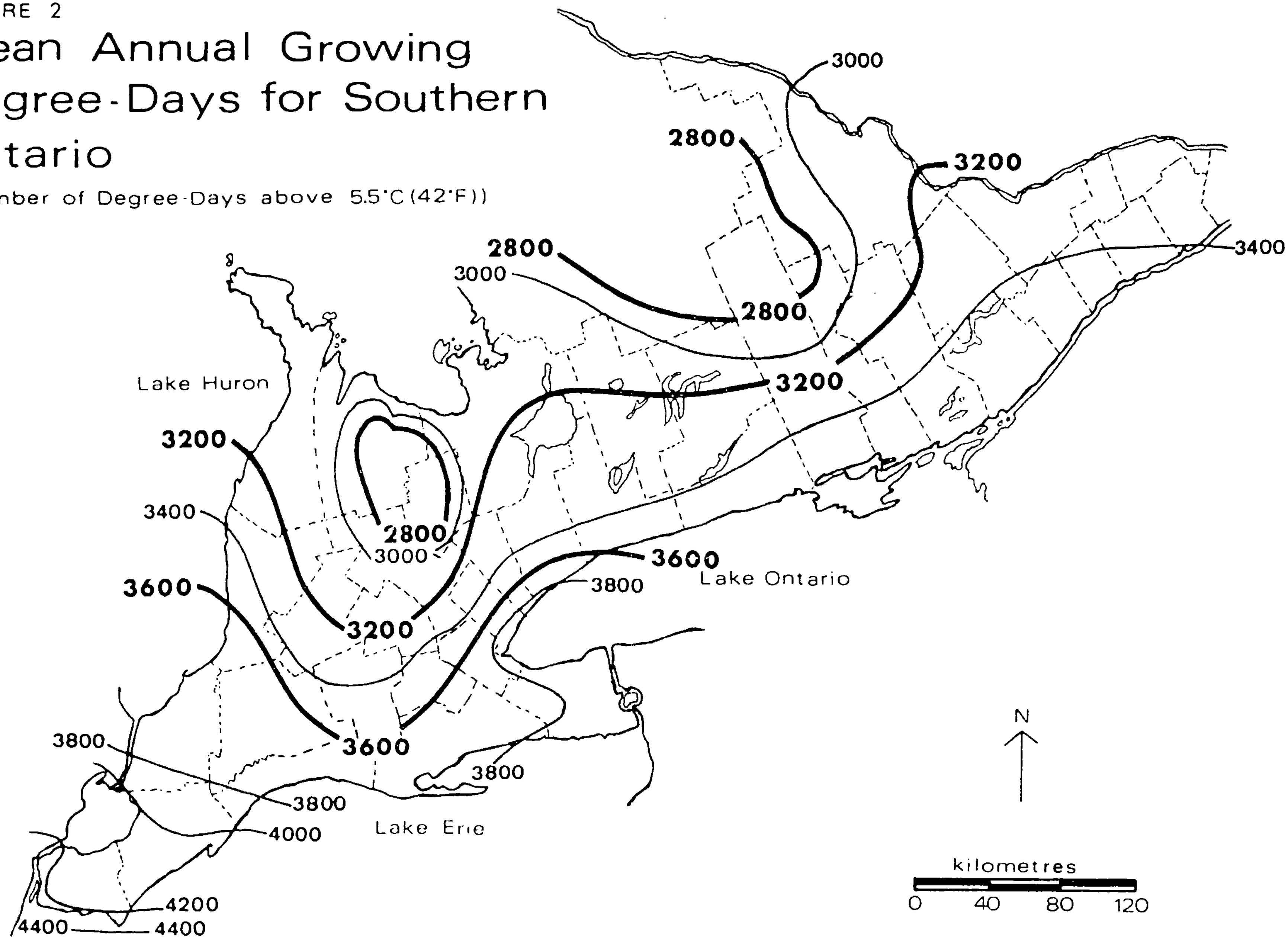
The contribution of soil type to productivity is well established both in agriculture and forestry. The inclusion of soils in the determination of wetland productivity is based on the assumption that in wetlands higher biological productivity would result when certain soil capability groups are present.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

To complete this section you should first consult various soil maps that are applicable to your area (See Appendix II). Read the "soil type" or "soil name" from the legend of the County Soil Map. For example, if the soil name is "Bearbrook Clay", then the soil type is clay. If the soil name is "Bainsville Silt Loam", then the soil type is silt loam. If the soil name is "Matilda Loam-Shallow Phase", then the soil type is loam or if it is "Grenville Loamy-Stony Phase", the soil type is loam. In each of the above, the soils are "mineral".

FIGURE 2

Mean Annual Growing Degree-Days for Southern Ontario

(Number of Degree-Days above 5.5°C (42°F))



Source : Adapted from Brown et al., 1968

In all cases, field work should confirm whether and where the wetland contains organic versus mineral soils. As a general rule organic soils occur in wetlands with extremely stable and "reliable" water supply whereas mineral soils are characteristic of flood plains and other areas where water levels fluctuate greatly from season to season or year to year. In wetlands where soil type is not designated (i.e. open water), the evaluator should try to establish soil type while in the field; if this is impracticable, the "undesignated" category should be entered.

1.1.3. Type of Wetland

Wetlands may be comprised of different kinds of ecosystems such as marshes, swamps, bogs or fens. These are known as wetland types. These wetland types differ in their typical form (appearance), in the quantity and quality of wildlife and other resources which they produce, and in their rate of primary productivity. Type of wetland provides one of the best measures 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. 1978, 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 per hectare per year (m.t./ha/yr); sedge marshes 10.4 m.t./ha/yr; reed marshes 21.0 m.t./ha/yr; swamp forests 10.5 m.t./ha/yr; and bogs, fens and muskegs 9.3 m.t./ha/yr.

For Ontario south of the Precambrian Shield, the major "wetland types" which are identified are known as bog, fen, swamp and marsh (Jeglum et al. 1974, Zoltai et al. 1975, Riley 1983).

Wetland types are determined by the field worker on the basis of the major plant associations of each wetland. Any particular wetland may be comprised of one or more wetland types. The percent of wetland area covered 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 is 0.5 ha.

The field worker should become thoroughly familiar with the characteristics of, and differences between, the four wetland types. Definitions of the types, given below, include abiotic as well as biotic (vegetation) characteristics of the types. Since the field worker is concerned mainly with the vegetation species for identifying the wetland types, some examples of "indicator species" characteristic of the different wetland types are provided in Appendix IV. A key to the wetland types is given in Appendix VII.

The following characteristics of the four wetland types are quoted or adapted from Zoltai et al. (1975), with additional descriptions appended.

(1) 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 waters and peat are strongly acid and upper peat layers are extremely deficient in mineral nutrients. Peat is usually formed in situ under closed drainage and oxygen saturation is very low. Although bogs are usually covered with Sphagnum, sedges may grow on them. They may be treed or treeless, and they are frequently characterized by a layer of ericaceous shrubs.

Bogs are almost always covered with Sphagnum, and are usually dominated by a low layer of ericaceous shrubs. Herbaceous species specifically adapted to bogs are usually present, such as a number of sedges and cotton grasses. Bogs may be open or treed with black spruce or occasionally tamarack.

(2) Fens are peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. They are covered by a dominant component of sedges, although grasses and reeds may be associated in local pools. Sphagnum is usually subordinate or absent, with the other more exacting mosses being common. Often there is much low to medium height shrub cover and sometimes a sparse layer of trees. The waters and peats are less acid than in bogs of the same areas, and sometimes show somewhat alkaline reactions. Fens usually develop in restricted drainage situations 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.

Fen peats generally consist of moss and sedge peats. Sphagnum, if present, is usually composed of different Sphagnum species than occur in bogs. Trees typical of fens are white cedar or tamarack.

(3) Swamps are wooded wetlands where 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 continually 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 or deciduous trees, tall shrubs, herbs and mosses.

Many swamps are characteristically spring-flooded, with dry relict pools apparent later in the season. There is usually no deep accumulation of peat.

Swamps include both forest swamps (having mature trees) and thicket swamps (or shrub carrs). Thicket swamps are characterized by thick growth of tall shrubs such as willow, dogwood, *Spiraea*, and alder. Both forest and thicket swamp have similar characteristics of water levels and chemistry. Both are assessed as "Swamp" wetland type, but can be distinguished on the wetland vegetation map by the predominance of either the "tree" or the "shrub" form. Soft maple, elm and black ash are among the best indicators of a hardwood forest swamp, and white cedar, tamarack and black spruce of conifer forest swamps.

(4) Marshes include 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 metres of peat accumulation. Waters are usually circumneutral to slightly alkaline, and there is a relatively high oxygen saturation. Marshes characteristically show zones or mosaics of vegetation, frequently interspersed with channels or pools of deep or shallow open water. Marshes may be bordered by peripheral bands of trees and shrubs but the predominant vegetation consists of a variety of emergent nonwoody plants such as rushes, reeds, reedgrasses, and sedges. Where open water areas occur, a variety of submerged and floating aquatic plants flourish.

The "Marsh" wetland type includes areas of open shallow water. These are areas of permanently open water, usually less than 2 metres deep, with water chemistry closely related to the type of water body they flank. Areas of open shallow water are associated with flowing or standing lakes, rivers or ponds, and usually have floating, submergent, or to a lesser degree, partly emergent vegetation in shallower areas.

The deep-water boundary of a marsh is drawn where water depth is 2 m or over.

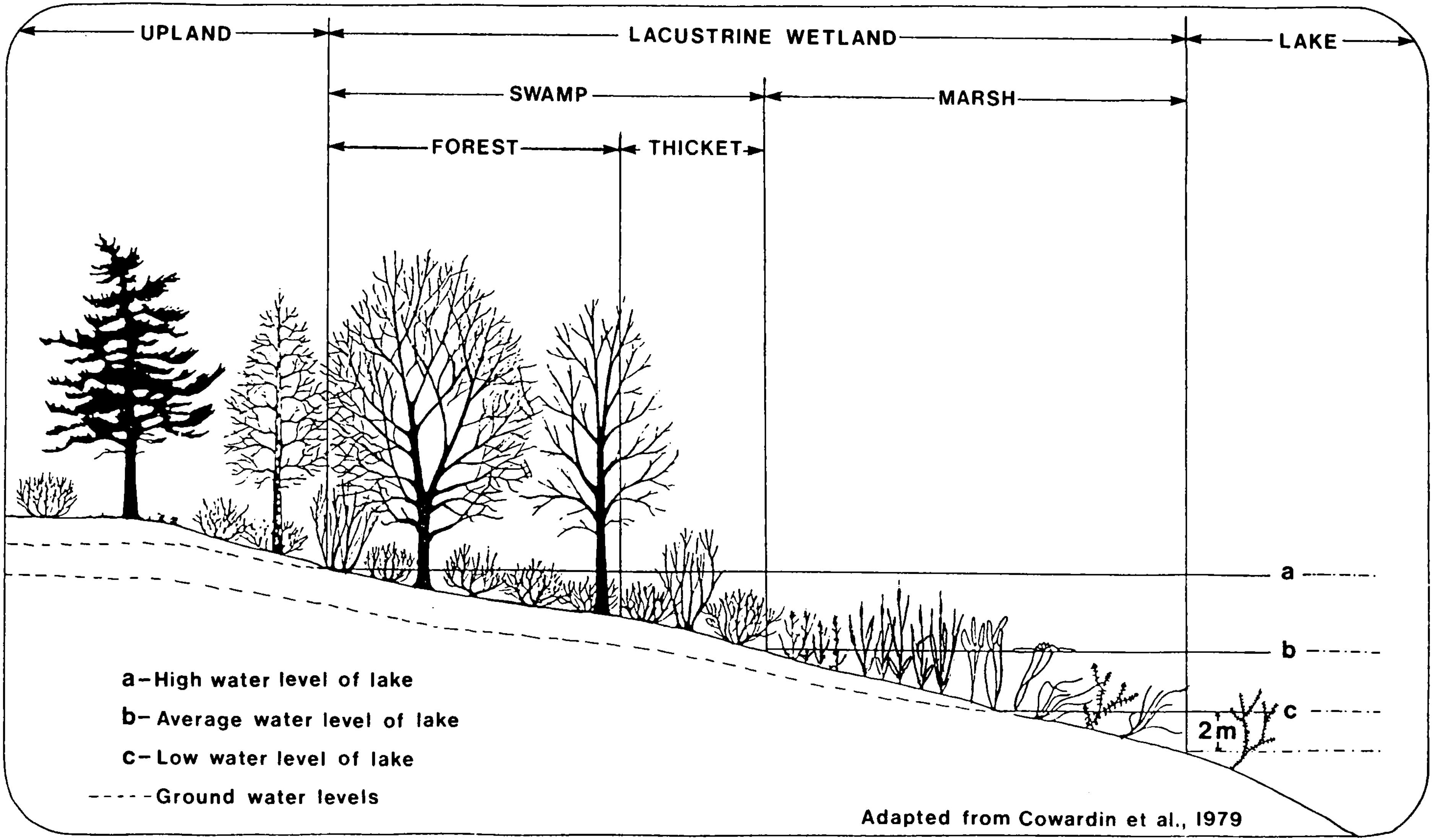
1.1.4. Site

The physiographic position of a wetland in the landscape defines its site. Four site locations are defined in this Evaluation. These are Lacustrine, Riverine, Palustrine and Isolated, illustrated in Figures 3, 4, 5 and 6 respectively.

The site location of a wetland strongly influences its productivity, based on the different sources supplying nutrients to the different sites. For example, Isolated and Palustine sites are considered to have low productivity since they rely on rainfall, some overland flow, and occasionally groundwater to supply nutrients.

FIGURE 3

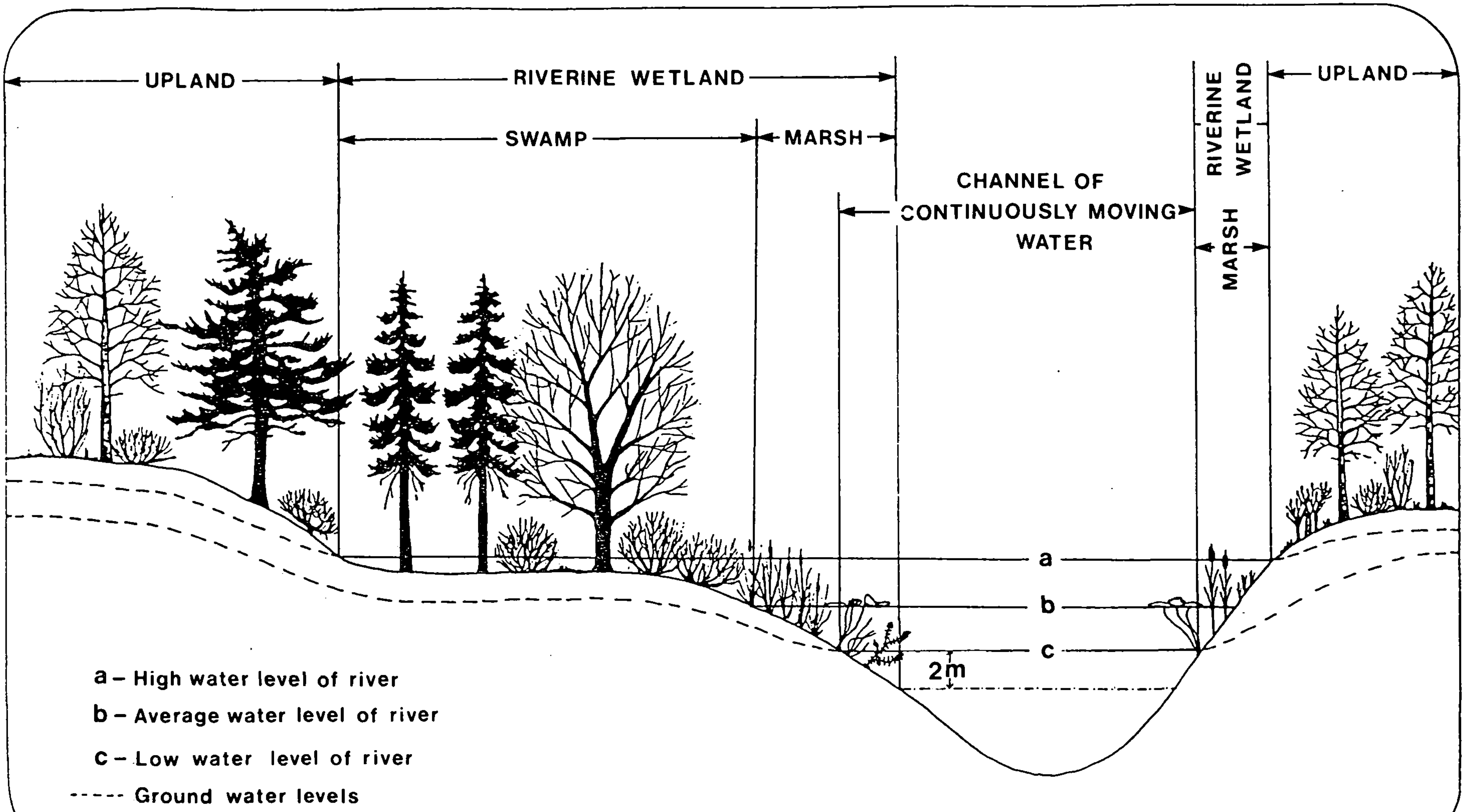
SITE TYPE: LACUSTRINE



Adapted from Cowardin et al., 1979

FIGURE 4

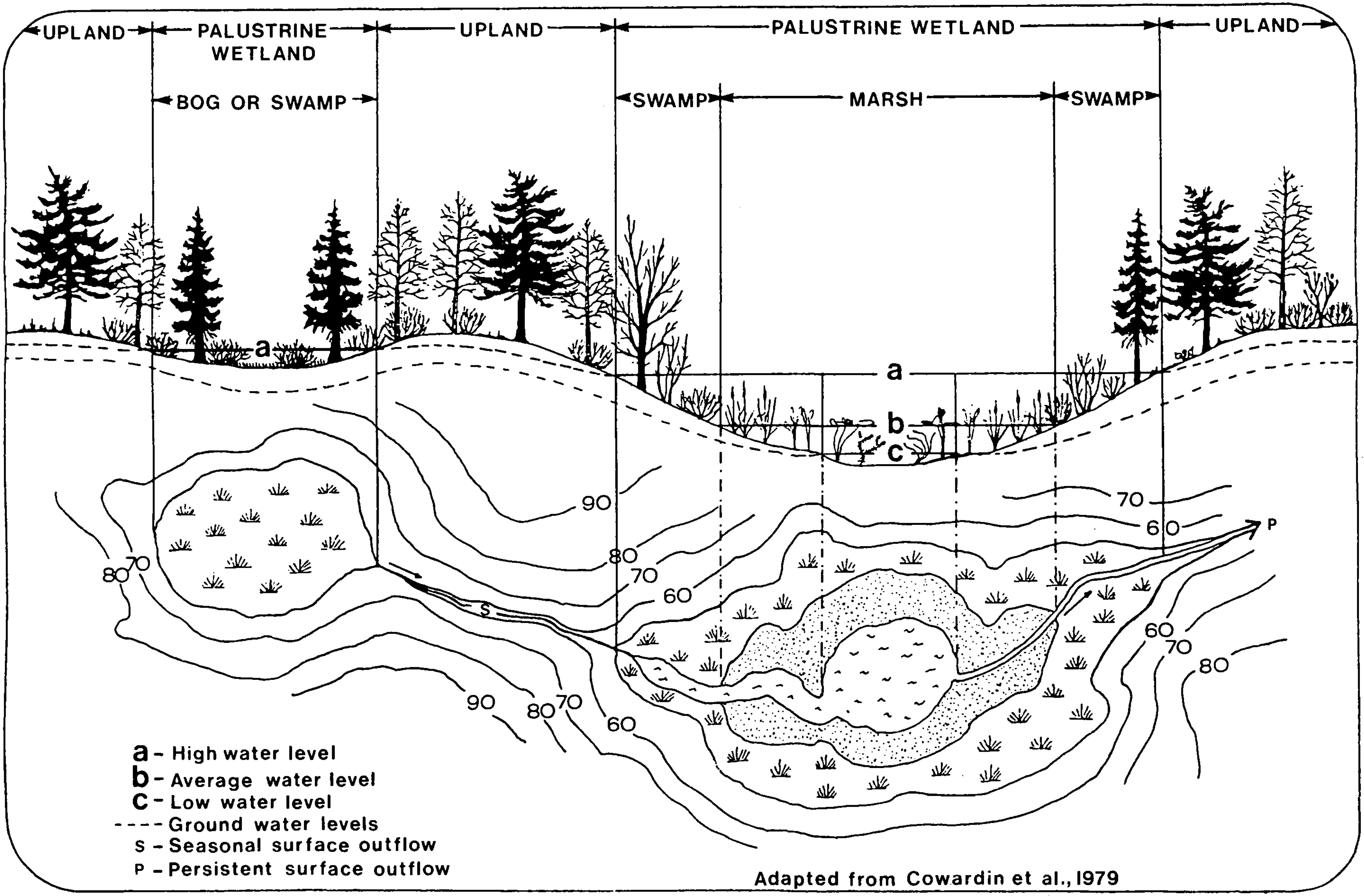
SITE TYPE: RIVERINE



Adapted from Cowardin et al., 1979

FIGURE 5

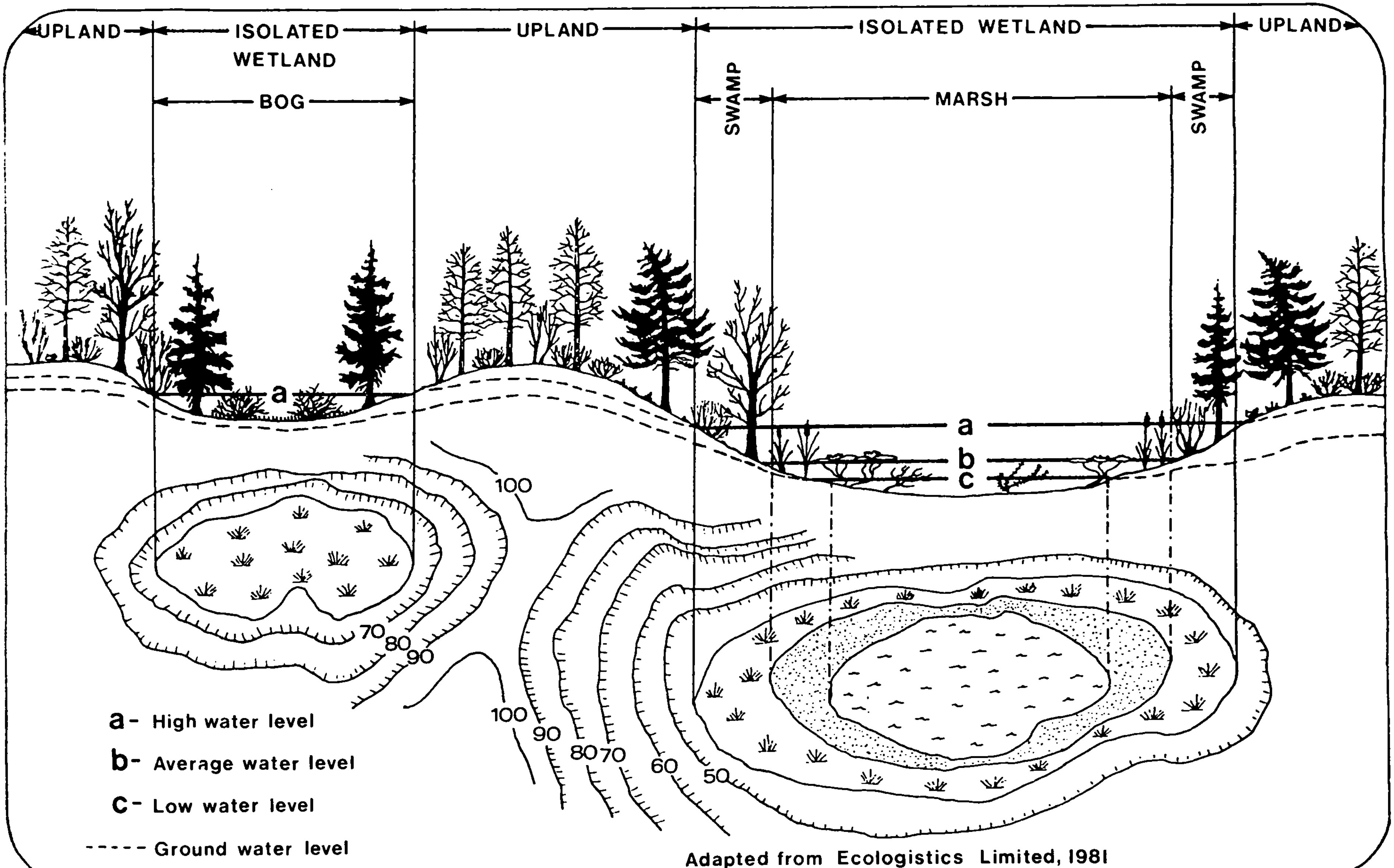
SITE TYPE: PALUSTRINE



Adapted from Cowardin et al., 1979

FIGURE 6

SITE TYPE: ISOLATED



Adapted from Ecologistics Limited, 1981

Lacustrine wetlands vary from moderate to high productivity. There is no constant flow of water in lakes to constantly replenish nutrient supplies, but depending on location, Lacustrine wetlands may be very productive due to local accumulation of nutrients. Productivity of Riverine sites increases with distance 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 increased naturally from the headwaters to the mouth.

There is no agreement among wetland specialists as to the precise definition of each of the site locations (Cowardin et al. 1979, Reid and Wood 1976). Definitions of site presented below are designed to meet the needs of this Evaluation System for use in southern Ontario.

Any particular wetland, depending on its size, complexity and physiographic position, may be comprised of one or more site locations, with the exception of Isolated sites. By definition, Isolated wetlands are found alone and do not include elements of the other three site locations. Where a wetland is comprised of several site locations, the field worker must estimate the percent of area covered by each site. In some cases, consideration of contour lines on topographic maps may help delimit site location. (Check direction of flow or absence of water in drains, inflows, outflows, etc. while in the field.)

Lacustrine wetlands (Figure 3) are associated with lakes, that is, large bodies of standing water that are usually larger than 8 hectares and deeper than 2 metres. Lacustrine wetlands include areas normally covered by the seasonally high water level as well as contiguous areas of wetland vegetation. By rule, wetlands adjacent to lakes greater than 8 hectares are considered to be Lacustrine. Wetlands around smaller lakes qualify as Lacustrine only if the water depth in the deepest part of the basin is deeper than 2 metres at low water.

Three categories for Lacustrine site are recognized:
i) Lacustrine (at rivermouth) - Where a river or stream enters a lake and forms a "rivermouth" wetland.
ii) Lacustrine (on enclosed bay) - Wetlands separated from a lake by a barrier beach in which lake waters may from time to time be sealed off.
iii) Lacustrine (exposed to lake) - A barrier beach is not present.

Where a wetland is a combination of two Lacustrine site locations, as for example Oshawa's Second Marsh, which is Lacustrine both at rivermouth and also on an enclosed bay (barrier beach present), it is necessary to estimate the % area of wetland that is occupied by each site. The field worker would need to determine if the dominant influence is exerted by the rivermouth location or by the lakeshore barrier beach.

Riverine wetlands (Figure 4) include the channel of continuously moving water to 2m depth as well as adjacent wetlands and normal flood plains of rivers and permanent streams. "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 wetland and upland vegetation (See viii above for discussion of boundaries).

A separate category of Riverine wetland is recognized - Riverine (at rivermouth) - which is similar to the Lacustrine (at rivermouth) category. It applies to wetlands formed where a river or stream enters one of Ontario's 5 large rivers (Ottawa, St. Lawrence, St. Clair, Detroit and Niagara Rivers).

Palustrine wetlands (Figure 5) are generally areas that occur in lands positioned physiographically above Lacustrine and Riverine wetlands. For this evaluation system, Palustrine wetlands are defined either by absent or intermittent stream inflow and either intermittent or permanent stream outflow. They are often headwater areas.

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 large permanent stream or river is Riverine.

Isolated wetlands (Figure 6) are defined as wetlands that have no surface runoff. The source of nutrients is precipitation, diffuse overland flow, and occasionally groundwater. An example of an isolated wetland is a wetland formed in a depression between drumlins.

1.1.5. Nutrient Status of Surface Water

Water that is more charged with dissolved solids and nutrients can produce more biomass than water with fewer nutrients. Water quality provides an indication of the habitat suitability of a wetland for certain plants, aquatic invertebrates, fish and wildlife. Conductivity measurements are interpreted as a measure of the fertility of the water and have become a standard, reliable method of measurement.

Other means of measuring the nutrient status of water in a wetland have been extensively utilized, such as pH, total alkalinity, dissolved oxygen, transparency and turbidity, total dissolved solids and specific conductance, as well as direct measures of phosphates, nitrates, etc. However these measurements would be too time consuming for use in this evaluation.

The nutrient status of surface water should be assessed at the "normal" or seasonally lower water level of the wetland, i.e. during the summer or early fall. It will not be possible to obtain T.D.S. for wetlands which are only seasonally flooded, or for fens or bogs which have no standing water. Where possible, conductivity readings should be taken at inflow and outflow areas, if present, in several areas of standing water, and/or in the littoral zone. Locations sampled for conductivity may be marked on the wetland map.

The "Manual of Instructions, Aquatic Habitat Inventory Surveys", developed by the Fisheries Branch of MNR, has been in operation since 1979 (Dodge et al. 1983) and the required equipment for the testing for total dissolved solids is available at the district offices. Existing MNR instructions to obtain the necessary conductivity information is shown in Appendix VIII. The conductivity reading is converted to total dissolved solids (T.D.S.) using Table A in Appendix VIII.

1.2. DIVERSITY VALUES

Wetlands which contain many kinds of aquatic and terrestrial habitat together with a relatively large number of wetland plant species will attract far more animal species than wetlands containing more uniform environments and monocultures of plants (Greeson et al. 1978). Wetlands with greater diversity meet the living requirements of more species. They provide alternate food sources for host and prey, parasites and predators, and more readily permit either the temporary or permanent survival of many species. In short, whatever are the causes or the benefits of diversity it is considered to be of paramount value because more wildlife species, often in great abundance, can be found in diverse environments.

Diversity values of a wetland are evaluated under six different categories: number of wetland types, vegetation communities, diversity of surrounding habitat, proximity to other wetlands, interspersion and open water types.

1.2.1. Number of Wetland Types

The more wetland types that are present within a single wetland, the more diverse the habitat available for wildlife. Hence, the diversity of wildlife species in the wetland as a whole will be greater. Golet (1976) considered the number of wetland types to be a very important contributor to total diversity. A wetland containing more than one wetland type should not be confused with a wetland complex; the latter may or may not be comprised of different wetland types but the individual wetlands are always separated by non-wetland environments.

Boundaries between wetland types should be shown on the wetland vegetation maps. The number of wetland types corresponds directly to types identified in 1.1.3.

1.2.2. Vegetation Communities

Vegetation communities are an important measure of diversity. More than any other factor, plants can satisfy the major requirements except water of wildlife. Vegetation provides nesting materials and sites, protection from predators, food, places to roost and loaf, isolation during the breeding season, etc. The more kinds of vegetation communities present, the more valuable is the wetland. Many studies have shown that for the large majority of species, differences in vegetation structure are more important to quality wildlife habitat than differences in individual plant species making up the vegetation communities. 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 diversity which in this evaluation is measured through vegetation communities.

A vegetation community may be defined as an assemblage of plant populations living in a prescribed area. Communities may be characterized according to several attributes. For the purpose of this Evaluation System, vegetation communities are recognized as assemblages of plant species having similar vegetation (life) form(s). 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 14 vegetation forms recognized for wetlands which were adapted from Golet (1976) to reflect differences not only in plant structure but also in ecology and stand density as well. These 14 forms are listed below, illustrated in Figures 7a and 7b, and examples of representative species are listed in Appendix IV.

Deciduous Trees
Coniferous Trees
Dead Trees
Tall Shrubs
Low Shrubs
Dead Shrubs
Herbs
Mosses
Narrow-leaved Emergents
Broad-leaved Emergents
Robust Emergents
Free-floating Plants
Floating Plants (rooted)
Submerged Plants

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: broad-leaved trees, tall shrubs, herbs, and mosses. This community might be contiguous to another community in the swamp consisting of broad-leaved trees, tall shrubs, herbs and free-floating plants. There may be several or more vegetation communities reflecting different combinations of forms, all found within a wetland type (i.e. swamp).

Minimum size for a vegetation community is 0.5 ha. This size limit may be reduced if the wetland is very small and where a smaller area may support wildlife with certain habitat requirements, as for example narrow strips of wetland vegetation bordering streams.

FIGURE 7a

Wetland Vegetation Forms

(and Symbols)

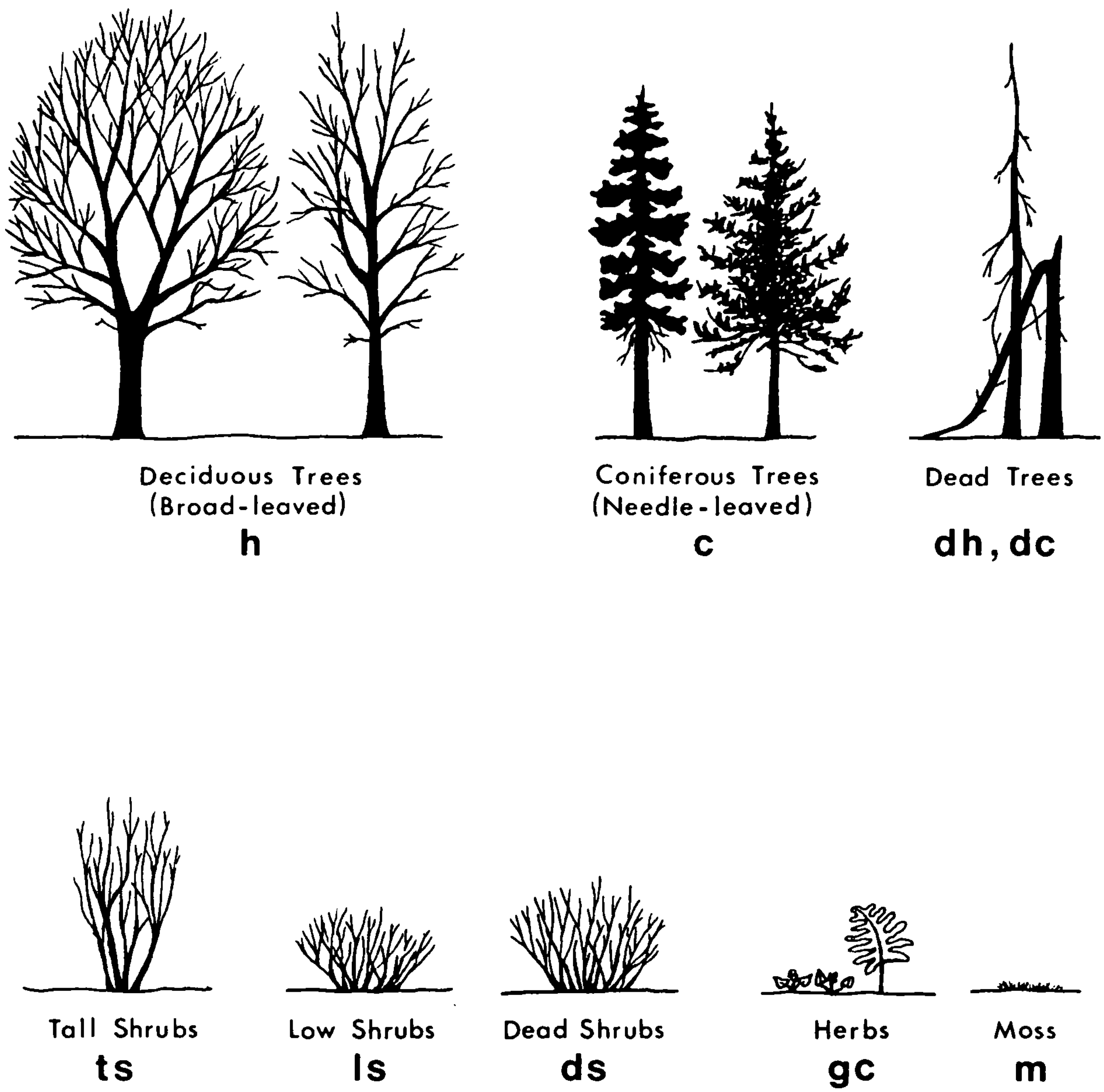
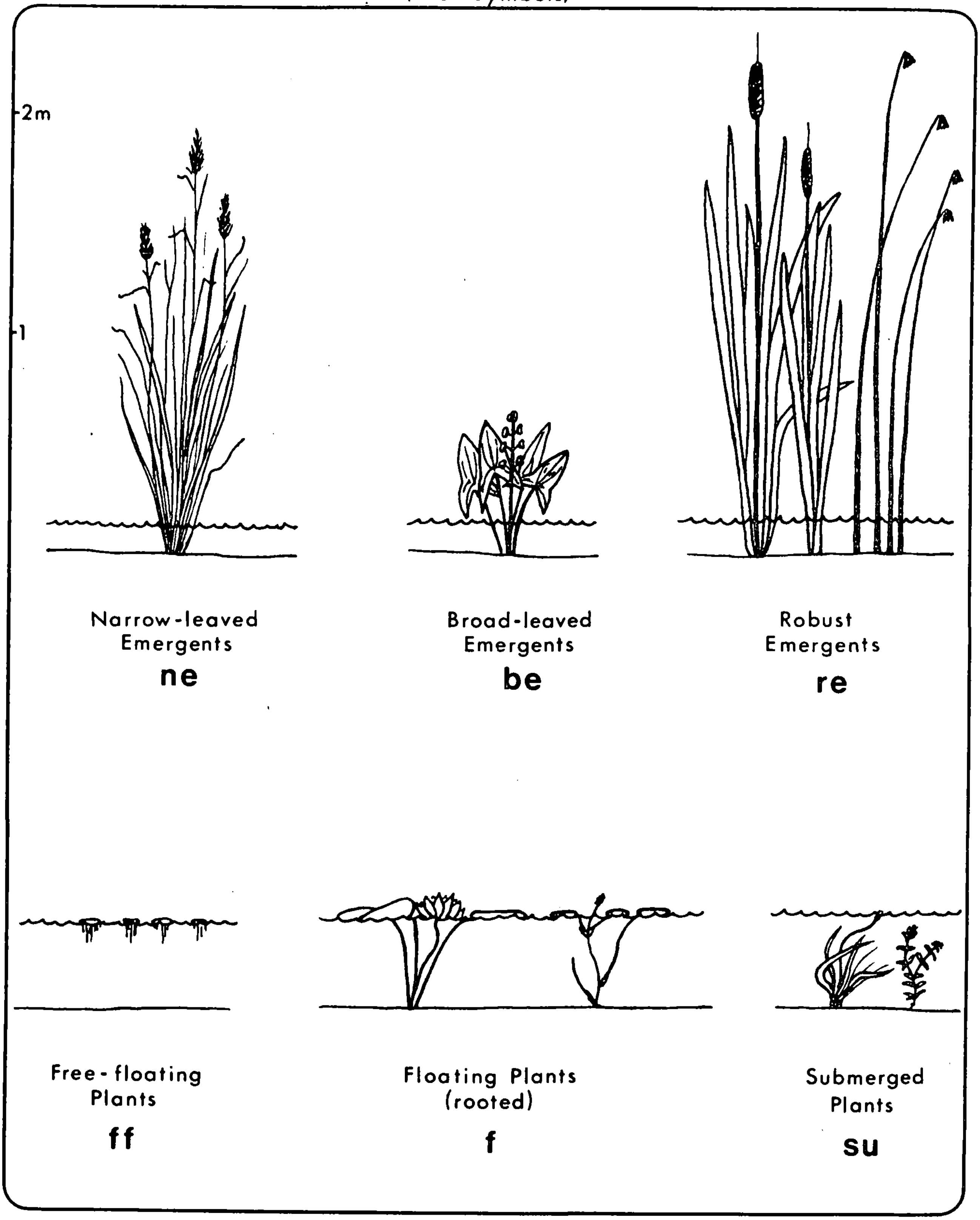


FIGURE 7b

Wetland Vegetation Forms
(and Symbols)



Approximately 25% of a vegetation community should have the vegetation form before it is included as part of the group. This "approximate 25% rule" can be applied in areas where intergradation between vegetation forms is gradual. Judgement based on visual field observations and interpretation of air photos should be the basis for applying the 25% rule.

The investigator must determine the composition of each vegetation community (consisting of one to several forms) and note these in the wetland vegetation map legend. The recommended approach in preparing the map is outlined in Appendix V, and a sample vegetation map and legend are shown. The vegetation communities are listed in the map legend and identified as to location in the wetland using an appropriate number code. To complete the data record, simply transfer the information from the List of Vegetation Communities in the map legend to the appropriate categories on the data record (1.2.2). For example, if there is a vegetation community consisting of two forms, robust emergents and free-floating plants, you would record these forms on the data record under b) Two forms, stating the dominant species if known. If you have used codes on your vegetation map, then enter the appropriate code. In this case, M6 was used to refer to marsh, community 6.

(e.g.) 1.2.2. b) Two forms
Code
M6 Typha (re) Lemna (ff)

1.2.3. Diversity of Surrounding Habitat

Wetlands cannot be evaluated in isolation from surrounding habitat since not only do many wetland species need certain kinds of upland habitat during some periods of their life cycle but many upland species make use of the wetland either daily or at certain times of the year. In general, the greater the diversity of habitat immediately surrounding the wetland the greater will be the wildlife value of the wetland. 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, and an undulating terrain. Intense human activity adjacent to a wetland may deter many species from ever utilizing the wetland. Surrounding natural habitat may serve as a "buffer", reducing disturbance of wildlife and satisfying some of their requirements. Many animals may use wetlands for a specific period in their life cycle and unless the wetland is easily accessible to them, it serves them little purpose.

The area of surrounding habitat that one should score is within 1.5 km from the edge of the wetland. An area must be 0.5 ha in size to be considered as a distinct patch of surrounding habitat. If parts of the wetland being studied have been converted to alternate uses one should consider the converted areas as surrounding habitat.

In wetland complexes, this variable pertains to uplands between and among the different wetlands of the complex as well as to lands within 1.5 km from the defined outer edge of the complex.

The principal source of information on surrounding habitat types will be air photos and direct field observations.

1.2.4. Proximity to Other Wetlands

This category provides a measure of habitat connectivity. Where wetlands are located so near to each other that wildlife can move from one to another from time to time to take advantage of more favourable habitat, food supply, etc. then the value of a wetland is enhanced (Golet 1976). Wetlands connected hydrologically by surface water including intermittent connections are the most valuable.

The location of a wetland near other wetland habitats can provide habitat diversity and add to the wetland's usefulness to wildlife populations. Two or more wetlands may be connected by streams, rivers or lake shores or they may be more weakly associated by low relief or small areas of upland. Where connections exist, wildlife can move more safely between wetlands. This can be especially important when a wetland is small and meets specialized needs of certain wildlife species. When describing this function, use should be made of topographic maps, soil maps and air photos but always coupled with direct observations in the field.

Habitat connectivity of wetlands in a complex should be assessed for the 2 most closely (highly) associated, or connected, wetlands.

1.2.5. Interspersion

Interspersion gives a measure of the presence and the length of "ecotones" or certain kinds of "edge" that exist between different vegetation forms. Whereas wildlife numbers are closely related to the total length of edge, wildlife diversity is a function of the number of kinds of edge (Golet 1976). Most wildlife species depend upon more than one habitat type and often 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, diversity of habitat is enhanced.

Edge is defined as the transition zone or ecotone between any two dominant vegetation forms. You should recognize edge when the border between a certain vegetation form contacting with another form is greater than 100 metres. For example, edge occurs where an area of floating plants contacts robust emergents, or where narrow-leaved emergents contact an area of broad-leaved emergents. Since long, narrow strips of wetland vegetation such as those that flank streams are known to be exceptionally significant to wildlife, they should be considered in the scoring even though the total area of such a strip might be less than 0.5 hectare.

Interspersion has been grouped into four types. These are illustrated in Figure 8.

Type 1 - Minimal interspersion -- One major vegetation form dominates the area. Small disconnected areas dominated by different forms occur within the major stand but contribute little to the diversity or total length of edge in the wetland.

Type 2 - Low interspersion -- Length and types of edge clearly restricted and limited. The wetland may consist of more than one major vegetation form zone, but zones are large and unbroken.

Type 3 - Medium interspersion -- Edge is moderate in length and diversity. There is some irregularity in the distribution of zones, but they remain largely intact.

Type 4 - High interspersion -- Edge is abundant and consists of many kinds. Zones are broken into segments of variable size and shape, and are scattered.

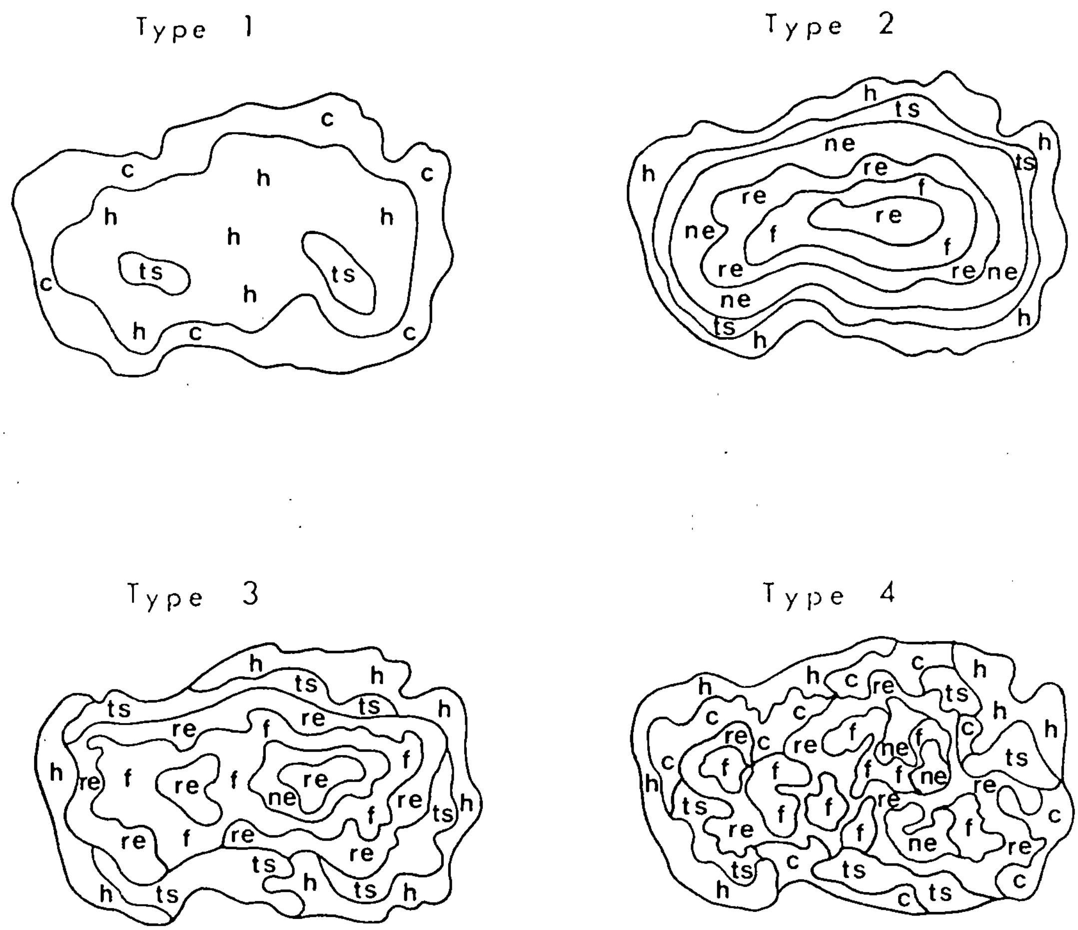
In Figure 8 the forms used are only examples to illustrate the concept of interspersion; they may be substituted with any of the forms in Figures 7a and 7b.

Edge may either be relatively simple, as in the case of a thicket swamp community bordering abruptly on a cattail marsh, or more complex where a deciduous tree, tall shrub forest borders on tall shrubs, emergents and floating vegetation. The type of interspersion should be evaluated by examining the final wetland vegetation map.

Where the type of interspersion varies between different sections of a wetland, then an "average" interspersion type should be recorded that best represents the wetland as a whole. For example, if 50% of a wetland is Type 1 and 50% is Type 4, then Type 3 would be checked as representing the average condition. Likewise, if the wetland is 20% Type 1 and 80% Type 4, then Type 3 would be checked.

FIGURE 8

Interspersion Types



KEY

c – **Coniferous Trees**

h – **Deciduous Trees**

ts – **Tall Shrubs**

ne – **Narrow-leaved Emergents**

re – **Robust Emergents**

f – **Floating Plants (rooted)**

Source: Adapted from Golet, 1976

1.2.6. Open Water Types

This index describes another facet of the edge effect - the relative proportion and areal configuration of open water to vegetated areas. This ratio may be critical to the survival of certain wildlife species, especially waterfowl. Since waterfowl species require dense cover for nesting and open water for feeding, a cover-to-water ratio approaching 1:1 is the optimum (Golet 1976).

Using the wetland vegetation map, the evaluator should assess both the percent and pattern of open water, where open water includes areas with floating and/or submerged plants. Open standing water among trees in a swamp is also assessed.

The eight open water types are illustrated in Figure 9 and described below. Since drawings are highly stylized, the descriptions may be the more useful reference.

Type 1 - Open water occupies less than 5% of the wetland area.
Type 2 - Open water occupies 5-25% of the wetland area, occurring in a central area.
Type 3 - Open water occupies 5-25% of the wetland area, occurring in ponds of various sizes; vegetation occurs in dense patches or diffuse open stands.
Type 4 - Open water occupies 26-75% of the wetland area, occurring over a central area.
Type 5 - Open water occupies 26-75% of the wetland area, occurring in a pattern where small ponds and "embayments" are common.
Type 6 - Open water occupies 76-95% of the wetland area, occurring in a large central area; vegetation is peripheral.
Type 7 - Open water occupies 76-95% of the wetland area; vegetation occurs in patches or diffuse, open stands.
Type 8 - Open water occupies more than 95% of the wetland area.

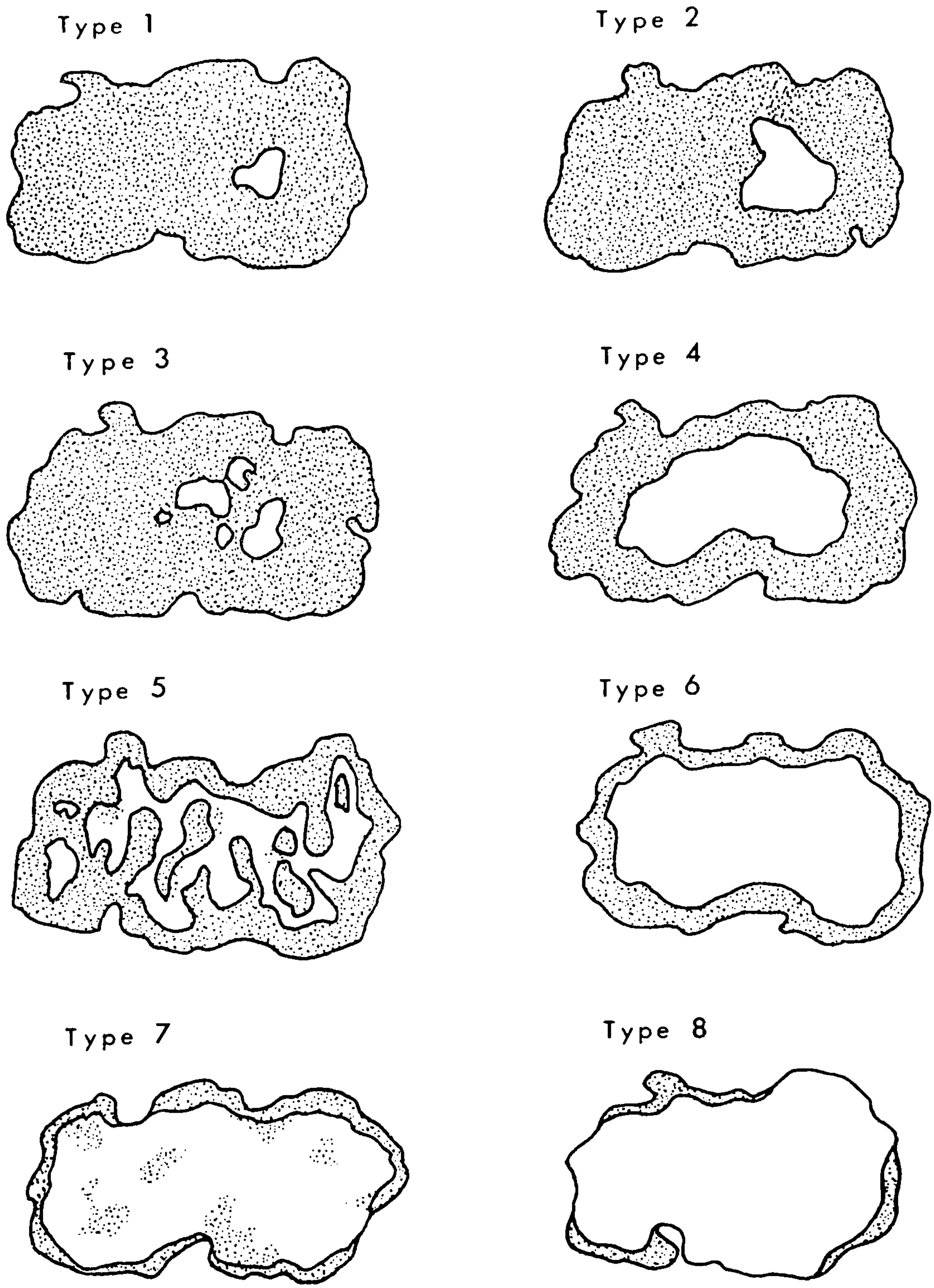
1.3. SIZE (Biological Component)

Wetlands are often valued for their size, since the larger a wetland the more likely it will contain various valuable features or expressions. In this evaluation the value given to a particular wetland for its size is always closely tied to quality of the wetland and the best measure of wetland quality is considered to be diversity. In contrast, the use of primary productivity variables appear to be irrelevant or misleading. Thus a large "poor quality" wetland made up of only cattail mats is considered to be considerably less valuable than another of the same size which contains abundant open water, is highly

FIGURE 9

Open Water Types

White areas indicate open water (including floating and submerged plants). Stippled areas indicate emergents, shrubs and trees.



Source: Adapted from Golet, 1976

interspersed and provides a stopover place for migrating waterfowl, for example. The value of size is therefore closely correlated with diversity, all of whose component values are "size dependent". Thus, diversity when coupled with size appears to provide an excellent indicator of the "biological" value of a wetland. In the evaluation, a special table (Size (Biological Component) Evaluation Table, Part II) has been prepared aimed at quantifying the value of size as a function of diversity. The relation between size and the size-dependent diversity score is not linear; adjustments have been made in the table to ensure that large but low diversity wetlands do not receive high scores for size and also to ensure that small, highly diverse wetlands receive extra size points. Making size a function of diversity would appear to optimize the accuracy of the size values.

The guidelines and criteria for establishing wetland size are outlined in (viii) above.

2.0 SOCIAL COMPONENT

The social values of wetlands are derived from information on resource products with cash value, recreational activities, aesthetics, education and public awareness, proximity to urban areas, ownership, accessibility and size.

2.1. RESOURCE PRODUCTS WITH CASH VALUE

Resources with cash value can be harvested from wetlands. Renewable resources include timber (both for lumber and firewood), wild rice, commercial fish, bullfrogs, snapping turtles and furbearers such as muskrats, beaver, mink and raccoons.

The principal sources of eastern white cedar (lumber, fence posts) and soft maple (lumber, firewood) are wetlands. Wild rice is of increasing importance as a source of income. Because of yearly variations in the density of rice plants, only the presence or absence of wild rice is considered. Coarse fish and bait fish are often harvested from some types of wetlands as are bullfrogs and snapping turtles and can often provide a source of income.

It is accepted that wetlands provide essential habitat for furbearers and that at least 1 furbearer will always be present either permanently or from time to time. For example, racoons are considered ubiquitous in wetlands in southern Ontario. It is assumed that some furbearers will be present at least from time to time.

The presence of resource products in a wetland provides a measure of values that would be lost if, by whatever means, a wetland is destroyed. It is the presence of a product (and not whether it is actually harvested) that is to be scored.

Sources of information on resource products are many and varied. Published literature, government officials, local residents and direct field observations can all play a role. MNR District Offices must be contacted for Section 2.1.3 (Data Record) related to the harvest of commercial fish (check for licenses issued), and 2.1.6 related to furbearers.

2.2. RECREATIONAL ACTIVITIES

Wetlands have value for a range of recreational activities including hunting, nature appreciation, fishing, canoeing or boating. As well, various forms of wetland-oriented recreation often take place at the edge of wetlands. These activities include hiking, viewing and ice fishing (on the adjoining lake). In winter, cross-country skiing may occur within wetlands, but it is not a wetland-dependent activity so it is not scored.

Information on wetland related recreational activities can be obtained from a wide variety of sources: Provincial wildlife staff, Conservation Authorities, local residents, publications, and through direct field observations. Evaluators are required to 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 are not relevant and need not be recorded.

<u>Criteria for Hunting</u>

<u>High Intensity</u>: Evidence of heavy use includes at least 10 duck blinds, or known concentrations of upland game or deer hunters; <u>if</u> numbers are available, then 100 or more hunter-days of recreation.

<u>Moderate Intensity</u>: Evidence of 2-9 duck blinds or hunters checked regularly by Conservation Officers; <u>if</u> numbers are available, then 21-99 hunter-days of recreation.

<u>Low Intensity</u>: Evidence of 1 duck blind, shotgun shells, reported use by non-agency sources, i.e. locals say "some fellows hunt there"; <u>if</u> numbers are available, then up to 20 hunter-days of recreation.

<u>Criteria for Other Activities</u>

Nature appreciation/nature study includes activities such as hiking or viewing along the edge of the wetland. Fishing includes ice fishing.

<u>High Intensity Use</u>: 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 the setting of limitations on the number of tours that can go through a wilderness trail per day. Use by large concentrations of people requiring the provision of facilities (i.e. washrooms, interpretation centers etc.) is also considered high intensity.

If numbers are available then 100 or more recreation days would be considered high intensity use.

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. Some examples are fishing and nature appreciation. If numbers are available then 21-99 recreation days could be used as a guideline.

Low Intensity Use: Low intensity uses are those that occur sporadically. Possible examples are occasional visits by naturalists and occasional fishing. Up to 20 recreation days can be used as a guideline if such information is available.

2.3. AESTHETICS

Aesthetics, like all other wetland variables, has a demonstrable worth to some segment of society. A considerable measure of subjectivity can be involved since "beauty is in the eye of the beholder". For that reason only two variables have been included within the aesthetics section.

2.3.1. Landscape Distinctness

When a wetland is notably distinct within the surrounding landscape, it is considered to have more social value since it is generally more visible and recognizable. Indistinct wetlands, are considered to have less value. They are similar in vegetation form to the surrounding habitat, as for example a silver maple-elm swamp next to a hard maple-white ash forest.

Wetlands that are clearly distinct from their surroundings are those in agricultural or urban settings which contrast sharply with the surrounding habitat. However, it is not intended that clearly distinct wetlands be limited to those in urban or intensive agricultural settings.

2.3.2. Absence of Human Disturbances

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. A wide selection of users, including fishermen, cottagers, etc. all prefer clean waters to ones that are eutrophic or otherwise polluted.

Man's impacts on wetlands are many and varied with respect to their scope, intensity and duration. Activities which vary in degree of impact and ones that may occur only in certain spots or along narrow strips include roads, utility right-of-ways, dumps, fill, impounding, stream channelization, dredging, drainage, the construction of buildings, docks, etc. In one form or another all of these activities have impacts and are in fact "conversions to other uses". But since the wetland still retains its integrity even in part, it is considered to be a functional wetland.

Polluted water is considered to be a form of human disturbance. Things to be noted include algal blooms, foul odours and poor water quality for swimming.

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

2.4. EDUCATION AND PUBLIC AWARENESS

The utilization of wetlands by school groups for educational exercises or observations, the use of wetlands for research in ecology, biology, hydrology, etc., and also the existence of facilities for the interpretation of nature and the environment are among identifiable wetland values. It is not the potential for any of these activities that is to be determined, but rather the actual current status of each activity.

The greater the amount of use by educational groups, the more valuable a wetland. When a wetland contains specific buildings, trails, literature, etc. or if programs exist whose purpose is to interpret the flora, fauna and ecology of the wetland then such a wetland has more social value than wetlands lacking such facilities or programs.

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

2.4.1. Educational Uses

To determine the amount of use of an area by organized school groups, the evaluator must contact school boards, school principals and/or biology teachers. Lists of wetlands that are visited can be obtained.

2.4.2. Facilities and Programs

An interpretation center 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 interpretative trails.

2.4.3. Research and Studies

When reviewing the background information on the wetland check reports, contact government offices etc. to determine whether, where and when any scientific research has been published. There is no need to search through Abstract journals.

Popular articles and unpublished government reports relating to the wetland environment can be acquired from Conservation Authorities, District MNR offices, local sportsmen's clubs and naturalist clubs.

2.5. PROXIMITY TO URBAN AREAS

When a wetland is located in or near an urban area, it can be identified, viewed and visited by more people. To many people wetlands near urban settings are more valuable than ones in wilderness settings. The fostering of appreciation for urban wetlands should contribute to the recognition and continued existence of wetlands.

Distances to the wetland should be measured by well-travelled roads from the nearest town or city.

2.6. OWNERSHIP/ACCESSIBILITY

Ownership-

The ownership of a wetland will have a bearing on its value to society. More people will benefit from the positive values of a wetland if it is in some form of public ownership. At the other end of the scale, wetlands in private ownership where the public is excluded would generally have less value, although obviously they could be of great value to the owner.

To determine ownership of a wetland, check with the relevant MNR District or Regional Office. Most Counties and Regional Municipalities have maps outlining areas of public and private land. Relevant Conservation Authority offices should also be contacted. A visit to a Land Registry Office should be a last resort. Public lands include: Crown land, Wildlife Management Areas, Conservation Authority lands, and County Forests. Estimate % of ownership categories when multiple ownership exists.

Accessibility-

The question of actual ease of access to a wetland (periphery) is considered to be a significant social value. Access is not necessarily a matter of distance. Rather it refers to the means or facilities for access such as good roads, waterways, trails etc. The more accessible wetlands generally have more social value. A user fee constitutes a restriction to activities and is a disincentive to public use.

Wetlands that are easily accessible can be reached by power boat or by motor vehicle on all-season roads. Wetlands with limited accessibility may have a road approaching the wetland but some effort is required to reach the wetland. Wetlands with difficult access require extended effort to reach the wetland due to distance from roads, navigable waterways or isolated geographic position.

2.7. SIZE (Social Component)

That the size of a wetland should be a factor in determining its overall social value is obvious. Yet, certain social values appear to be irrelevant to size - as for example ownership, educational use, and accessibility. 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 small wetlands could be more valuable socially than some large ones. In the evaluation a special table (Size (Social Component) Evaluation Table, Part II) has been prepared which tries to identify the actual value to be ascribed to wetland size.

Use measurement from question No. viii in the Wetland Data Record (see Part III).

3.0. HYDROLOGICAL COMPONENT

In creating this system of evaluation for wetlands, an inordinate amount of time and thought was devoted both to identifying and defining just what attributes of wetlands should be studied to arrive at a practicable evaluation system for hydrological values. In the final analysis, only three hydrological values have been accepted for evaluation: flow stabilization, water quality improvement, and erosion control. The rationale for excluding a variety of additional known or purported hydrological values is presented at the end of this section.

A WETLAND IS EVALUATED FOR HYDROLOGY USING THE DOMINANT SITE LOCATION (1.1.4)

3.1. EFFECT OF ADJOINING LARGE WATER BODY

For wetlands that are Lacustrine bordering on any one of the Great Lakes, or Riverine located on one of Ontario's 5 large rivers (Ottawa, St. Lawrence, Niagara, Detroit, or St. Clair Rivers), the influence of these large water bodies is overwhelming. For practical purposes, these wetlands have no value for detention of flood waters relative to the very large surface storage area offered by the Great Lakes/5 large rivers.

Where size of the adjoining lake or river is a major factor, as described above, then the wetland is deemed to have negligible value for flow stabilization, and Section 3.2 is not assessed. For these wetlands, evaluation of the Hydrological Component begins with Section 3.3, Water Quality Improvement.

3.2. FLOW STABILIZATION

The most important hydrological value of wetlands is that of the stabilization of flows of rivers and streams. This value is realized through the fact that wetlands act like basins which can accumulate water during floods and then release it in various ways over a more extended period of time. Thus, flood crests are reduced and the base flow of water between floods or during the summertime may be increased.

Flow stabilization is here divided into two "sub-values": detention due to surface area (3.2.1) and the augmentation of flow (3.2.2). The former has major value in controlling flood crests while the latter often causes streams to flow all summer long.

Evaluate all wetlands EXCEPT where Lacustrine bordering on the Great Lakes OR Riverine adjoining one of Ontario's 5 large rivers (see above 3.1)

3.2.1. Detention Due to Surface Area

When flood waters can accumulate within a wetland, then water is temporarily detained on the wetland for eventual exit either through outflow, evapotranspiration and possibly, ground water recharge. Areal accumulation of flood waters in the wetland can take place in soil interstices. If the soil is already saturated then water can accumulate on the surface. Examples of surface accumulation would be on ponds, lakes, rivers or behind artificial dams. Whether the detention is over the surface area or in the soil, a large volume of flood waters may be temporarily detained, thus reducing flood crests downstream.

To begin with (FIRST STEP), points up to a total of 110 may be given to a wetland if a certain relationship exists between catchment basin size and total detention area of all lakes, reservoirs and wetlands above the wetland. Then, in a series of steps, points can be subtracted or "discounted" from the wetland depending on the nature or expression, etc. of each successive variable as it applies to the wetland that is being evaluated. Thus, in the SECOND, THIRD and FOURTH steps, points may be discounted and the accumulating total summed until one completes the FOURTH Step. At this point the minimum allowable total is 0. Then, in the FIFTH step points are added for size. After all evaluation steps are completed, one obtains a detention value for the wetland. This value can total anywhere from 1 to 150, for wetlands assessed for this value.

In the evaluation, the relation between size of catchment basin and total detention area within the catchment basin provides the first step for the evaluation of detention.

3.2.1.1. Size of Catchment Basin above Wetland Outflow: (FIRST STEP)

Size of a wetland's catchment basin provides a good indication of the volume of water that must eventually exit through the wetland. Other things being equal, the larger the catchment basin, the larger the potential for major flood crests during peak flows. However, when a catchment basin contains many detention areas where flood waters can spread out over surfaces of wetlands, reservoirs or lakes, then peak flows downstream would be significantly reduced. Flood crests would spread out over a longer period and summer base flows could be increased.

A wetland's catchment basin is the entire area of landscape from which the wetland receives its water. Obviously, some wetlands can have catchment basins only a few hectares or square kilometres in size; other wetlands, particularly those along larger rivers such as the St. Lawrence may have extremely large catchments. A catchment area always includes the wetland itself. When two or three streams flow through or meet in a wetland, then the catchment includes all areas drained by the two or three streams. In headwater areas, for a headwater wetland, water often drains from the wetland into two or three different creeks and the creeks in turn may drain into different river systems. In this case the entire wetland itself plus any upland areas draining into it will comprise the catchment basin. However, if a wetland were to occur further downstream on one of the headwater creeks, then its catchment area includes only that portion of the catchment basin of the "headwater wetland" which drains into the downstream creek, plus all the uplands contained in the downstream wetland's catchment basin.

Catchment basin is difficult to deal with when the wetland is located on a man-altered system such as the Rideau River and Canal. In this system, the lakes are all interconnected by a river or canal. A wetland may be located on a creek running from the system or on the system itself, and since the lakes are all interconnected, the catchment basin may be quite large, at least on paper. In these circumstances, simply determine the catchment basin including all interconnected lakes, pertinent tributaries and wetlands. Then determine total size of all lakes, etc. draining into the wetland, also including all interconnected lakes within 30 km. Then proceed as you would for any other wetland.

It is important to take particular care in determining the size of a wetland's catchment. For catchment basins in the vicinity of 200 sq. kilometres or smaller, one of the best ways to establish catchment area is through a careful study of N.T.S. maps. With a pencil, one can slowly circumscribe the area that drains into the wetland by following the height of land (as determined by contour lines) which circumscribes the wetland's catchment. Then, the number of square kilometres (the U.T.M. Grid) in which a grid square or a portion of a square falls can be totalled. As a last exercise, one should count the number of grid squares that the traced perimeter line bisects. By dividing this number in half and subtracting the answer from the first total, one can obtain an acceptably accurate measure of catchment size.

For catchments larger than about 200 sq. kilometres, size may be ascertained through use of drainage sub-basin maps produced by most Conservation Authorities. A rough approximation should be used if information is not available.

Many southern Ontario wetlands are located near agricultural drains; others have drainage ditches at their edges or penetrating into the wetland's interior. It is absolutely essential (especially for Palustrine wetlands) that the evaluation team determine the direction of flow of waters in all such drains, since it is not possible through use of topographic maps alone to determine with certainty the direction of water flow. Some drains flow <u>into</u> wetlands and a wrong assumption regarding flow direction will inevitably produce major errors in circumscribing the catchment basin size. Field visits, especially during spring runoff or after major rainfall are not only invaluable but often essential.

3.2.1.2. Total Size of all Detention Areas (Lakes, Reservoirs and Wetlands) Draining into the Wetland (FIRST STEP)

Through use of N.T.S. topographic maps, field observations, and discussions with staff of Conservation Authorities, the evaluation team can determine the total size of all "basins" above the wetland in which flood waters become temporarily detained.

If wetland waters originate from a branching network of upstream creeks or rivers, then all detention areas on all these creeks and rivers must be included. The manner in which one calculates the contribution of "headwater" wetlands is outlined in 3.2.1.1 above.

3.2.1.3. Size of Adjoining Lake (Lacustrine wetlands only) (SECOND STEP)

Lake size has a major bearing on the detention value of Lacustrine wetlands. All of southern Ontario lakes occur in drainage basin systems (including the Great Lakes) and therefore all wetlands located on such lakes must be considered for their value in detaining flood waters. The size of Ontario lakes varies from that of the Great Lakes to lakes that are less than 8 hectares in size. As a general rule, wetlands located along small lakes have more detention value than those located along larger lakes. For this evaluation, a wetland bordering on any of the Great Lakes is considered to have no detention value irrespective of the level of flood waters. In comparison, wetlands on small lakes can have considerable detention value especially if the wetland is larger than the lake.

Size should be determined from N.T.S. maps or, for smaller lakes, from other large scale maps. Conservation Authorities may have precise measurements available.

3.2.1.4. Size of the Adjoining River (Riverine wetlands only)

Wetlands that are located along one of Ontario's 5 large rivers (Ottawa, St. Lawrence, Niagara, Detroit and St. Clair) will have an extremely low detention value because the rivers act effectivly like a lake. This variable was assessed in 3.1, above. Conversely, wetlands on smaller rivers will often have high detention values.

Unlike the 5 large rivers, all other southern Ontario rivers originate in the province and therefore only their "lower reaches" can be considered to be in an intermediate class. Where wetlands are located along these lower reaches, the effect of detention areas is largely taken into account in the <u>second</u> and the <u>third</u> steps.

Therefore, there is no requirement to actually measure the size of a wetland's adjoining river, and this size variable is not scored (i.e. no points are deducted).

3.2.1.5. Location and Size of Detention Areas (Lakes, Reservoirs and Wetlands) within 30 km above and below the wetland (THIRD STEP)

A wetland's value for detention will be significantly reduced if, for example, a lake, reservoir or another wetland exists immediately upstream or downstream from the wetland or if one of Ontario's 5 large rivers is located downstream from and near to the wetland. The further upstream is the nearby lake, reservoir or wetland, the more detention value the wetland in question will have since the wetland will also be receiving flood waters from that portion of its catchment basin between the wetland and detention areas above. If a lake, reservoir or wetland is located below the wetland then obviously any flood crests going through the wetland will be able to "spread out" over the surfaces of detention areas located below the wetland's exit. The effect would be to reduce the height of flood crests downstream. Hence the wetland will have more detention value if detention areas downstream are small and particularly if the detention areas are more distant from the wetland exit.

Information for this variable should be obtained from topographic maps and/or Conservation Authorities. The 30 km distance is obtained by following the stream or river rather than "as a crow flies". Tributaries and small wetlands above the wetland in question are to be included for evaluation purposes. Assessment of those wetlands downstream should be confined to the main outflow and not to tributaries and their corresponding wetlands.

3.2.1.6. Land Use along River or Stream Shoreline Below the Wetland (FOURTH STEP)

(For Palustrine and all Riverine wetlands except those located along the 5 large rivers)

The total score that a wetland receives for detention is partially dependent upon the kind of land use in areas below the wetland that may be flooded. Thus, if agricultural fields, towns or urban developments are located downstream, then the presence of the wetland will have some value for water detention. In comparison, flooding in downstream natural ecosystems would be a natural event with some species adapted to or even dependent on the flooding. Flood plains are often difficult to delimit. Therefore the approach taken in this evaluation is to measure land use for 20 km below the wetland exit, following the shoreline on both sides of the river or stream.

N.T.S. topographic maps and air photos combined with field observations are the basis for this measurement.

3.2.1.7. Size (Hydrological Component) (FIFTH STEP)

Size of wetland is evaluated only after all major factors affecting a wetland's detention value have been discounted (i.e. steps 2, 3 and 4 above). The larger the wetland the more value it has for 3.2.1, "Detention Due to Surface Area". This series of evaluation steps began with the assumption that all wetlands are the same size.

Since all wetlands not located on the Great Lakes or on any of the 5 large rivers have at least some detention value, the values allocated at this step are added to rather than discounted from the accumulated value at the end of the fourth step. This will enable even small wetlands to receive at least 1 point for detention as indeed they should.

The detention value of a wetland is a function of its size in relation to other hydrologic influences. The size obtained in the Wetland Data Record (see viii) should be used in this part of the evaluation.

3.2.2. Flow Augmentation (Palustrine wetlands only)

In southern Ontario, a wetland's physiographic position on the landscape, when taken together with the relation between its size and its catchment basin, will determine the wetland's value for "flow augmentation". Thus, large wetlands located in headwater areas will always have significant value, not only in "holding back" flood crests (as measured in 3.2.1), but they may have value in stabilizing stream flow well into the summer, beyond times of flooding. This value is seen as separate and distinct from the flood control value as measured under 3.2.1 above. It is a function mainly of Palustrine (headwater) wetlands. It is recognized that for such wetlands, downstream flow augmentation may occur not only through gradual surface outflow but also through subsurface seepage. Whether or not such seepage (and a corresponding flow augmentation) occurs, it is considered to have been measured.

A wetland's value for flow augmentation is dependent upon the relation between its size (wetland area) and catchment basin size.

3.3. WATER QUALITY IMPROVEMENT (All wetlands)

Wetlands improve water quality in two ways. First, wetlands have the capability to remove nutrients from surface waters during the growing season and second, they can tie up nutrients more or less permanently in gradually accumulating organic detritus (sediments).

3.3.1. Short Term Removal of Nutrients from Surface Water

This wetland value is based upon the fact that either directly or indirectly animals and plants during their active growth period absorb nutrients from water or sediment. Hence, water in or moving through wetlands will tend to have fewer nutrients during the growing season, thus influencing water quality both in and near the wetland or in rivers, streams or lakes downstream. Of course, it is understood that when these plants decay, absorbed nutrients are released back into the water (unless the plants are physically removed from the wetland in the summer or early fall). This value is ascribed to wetlands because of the effect that the temporary water quality improvement would have on water-oriented recreational activities and, possibly, on wildlife populations during the summer. At the time the nutrients are being released into the water (fall, winter and spring) recreational activities dependent on water quality are essentially non-existent.

In evaluating water quality improvement the following three variables are considered.

3.3.1.1. Site Type

The contribution of site to short term removal of nutrients is based on the assumption that absorption of nutrients tends to be greater when water is passing or flowing through submergent or emergent aquatic plants. Thus Riverine wetlands have more value than Isolated or Palustrine.

Instructions for determining site type are outlined in the Biological Component (see 1.1.4). This variable should be assessed using the dominant site type.

3.3.1.2. Actual Wetland Area Dominated by Robust Emergents and Submergents

The efficiency of the nutrient absorption process is influenced by the kind of vegetation forms present in the wetland as well as the size of the area over which they grow. Robust emergents and submergents are known to be relatively efficient at nutrient absorption (Greeson et al. 1978). During the spring and summer these plant forms are immersed or standing in the water. Swamps, bogs and fens may have no surface water during the summer and on that account are not considered to be as efficient at nutrient absorption.

The actual area dominated by robust emergents and submergents should be measured directly off the vegetation map.

3.3.1.3. Land Use in Catchment Basin

More nutrients and other chemicals are added to surface waters in those areas where urban and agricultural developments are widespread. Hence, any wetlands within drainage basins where urbanization and agriculture predominate will have more eutrophic waters than ones in forested and/or natural vegetated areas and this means that the wetland's role in nutrient removal becomes more important.

Type of land use within a wetland's catchment basin is determined in various ways depending upon the size of the catchment. For small catchment areas (less than 200 sq. km), N.T.S. maps are indispensible and field work is often useful. For larger areas, the application of general geographical and land use knowledge of Ontario should be used.

3.3.2. Long Term Nutrient Trap

Wetlands where sediments (particularly organic sediments) are actively accumulating create a "sink" for nutrients, with nutrients being trapped for very long times (hundreds or thousands of years) in the sediment layers. Since buried nutrients are unavailable to algal production in the overlying surface waters, wetlands having a net increase of sediments over time can be said to play a role in water quality improvement.

To a large degree, the physiographic circumstances of a wetland on the landscape will determine the extent to which it can act as a net receiver of nutrients. Thus wetlands located in places where rivers enter larger lakes or reservoirs and deposit some of their sediment load are ones that would have value as long term nutrient traps. As well, build up of organic soils would favour the net accumulation of nutrients. Obviously, a careful consideration of the dynamic nature of the wetland is important in order that the correct decision be made. The field worker should decide, while at the wetland, whether a delta is being actively formed, etc.

3.4. EROSION CONTROL

Wetland vegetation is considered to be the most important factor in erosion control. Vegetation ameliorates the effects of soil erosion on river banks, lake shores, etc.

3.4.1. Erosion Buffer (Lacustrine and Riverine wetlands only)

Vegetation forms present, both in the water and on the banks (but within the wetland), are evaluated to determine the value for erosion buffer in Lacustrine and Riverine wetlands. The shorelines in most Isolated and Palustrine wetlands are not considered to be particularly vulnerable to erosive forces of wetland water.

In Lacustrine wetlands, shoreline marshes and swamps can provide an effective buffer against the erosive effects of waves. The value of the wetland would be greater when the length and width of the vegetation is greater and when the fetch (for definition, see below) is longer. Barrier beaches, narrow arms and inlets could reduce the effect of fetch to zero. All other wetlands provide control against erosion by protecting the soil with stabilizing vegetation.

Figure 10 shows areas of Riverine and Lacustrine wetlands where erosion buffering may take place. Erosion buffer is assessed for the dominant site type.

3.4.1.1. Riverine Wetlands

In Riverine systems, the erosion problem occurs principally when water levels are high. It is the kind of vegetation occupying the shoreland and the flood plain that is instrumental in reducing erosion. Assess dominant vegetation form.

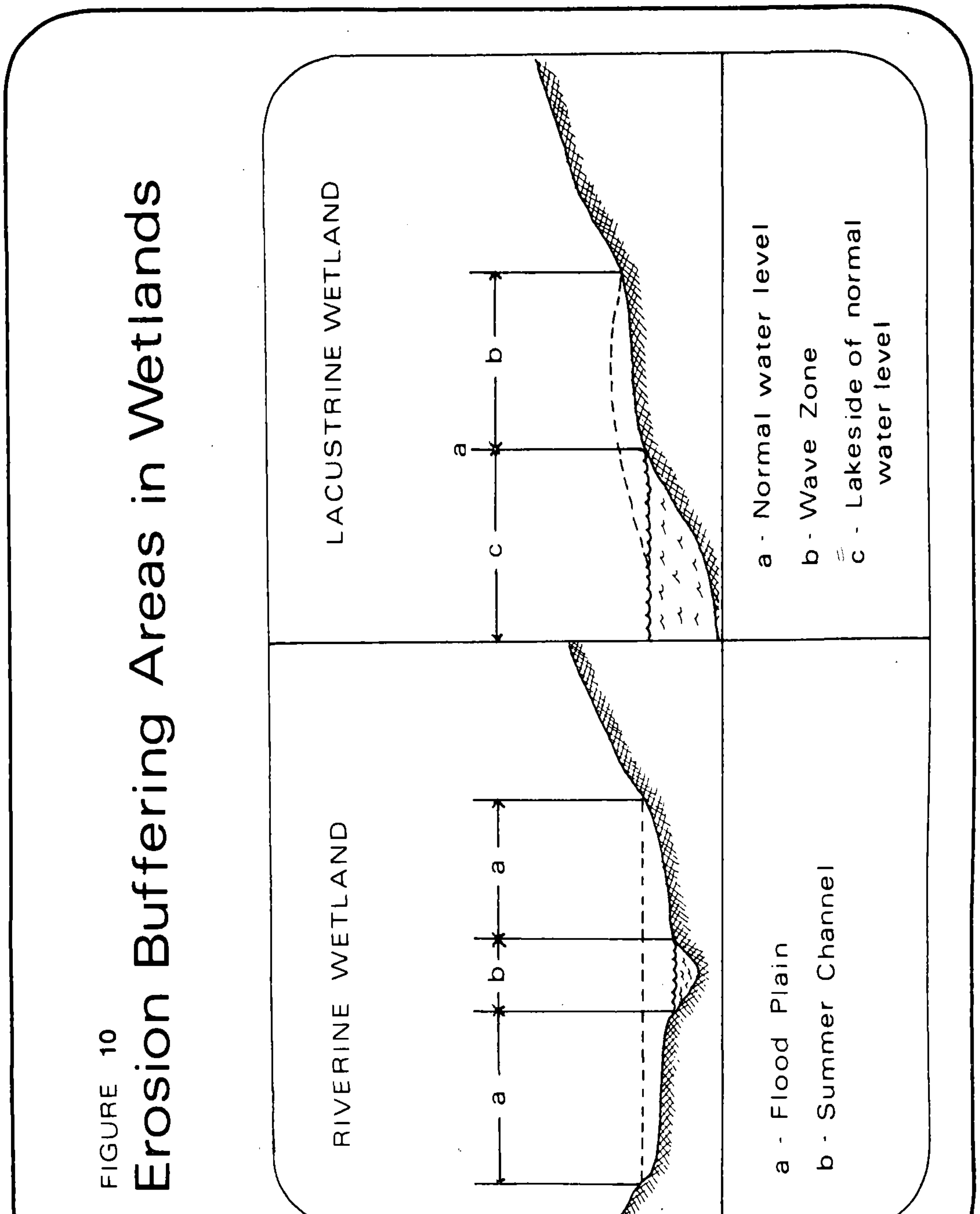


FIGURE 10
Erosion Buffering Areas in Wetlands

3.4.1.2. Lacustrine Wetlands

In Lacustrine systems, wave action is the primary erosive force. Both the vegetation within the wave zone (submergents) as well as the wetland vegetation above the lake (trees, shrubs, emergents) will have an influence. Vegetation in the wave zone can help bind shoreline soils whereas vegetation to the lake side of this zone can serve to reduce the energy content (velocity) of the wave itself. Assess dominant vegetation form.

3.4.1.3. Fetch (Lacustrine and/or Riverine wetlands on any of the 5 large rivers)

Fetch is a measure of the open water distance over which waves form due to wind. This should be determined using N.T.S. maps, or other maps of appropriate scale.

3.4.2. Sheet Erosion (all except Lacustrine wetlands)

Figure 11 maps the average annual rainfall "R" values for southern Ontario. The "R" value is an index of soil erodibility which may be caused by intense rainfall. The index was derived from long-term rainfall records (van Vliet et al. 1978). "R" values for Canada have recently been updated (Wall et al. 1983). A wetland located in a part of Ontario where the "R" factor has been calculated at 100 would be more valuable at preventing soil erosion than a similarly-sized wetland located in a part of Ontario where the "R" factor has been calculated at 50.

The appropriate interval should be read directly from Figure 11.

3.5. RATIONALE FOR EXCLUDING SOME HYDROLOGICAL VALUES

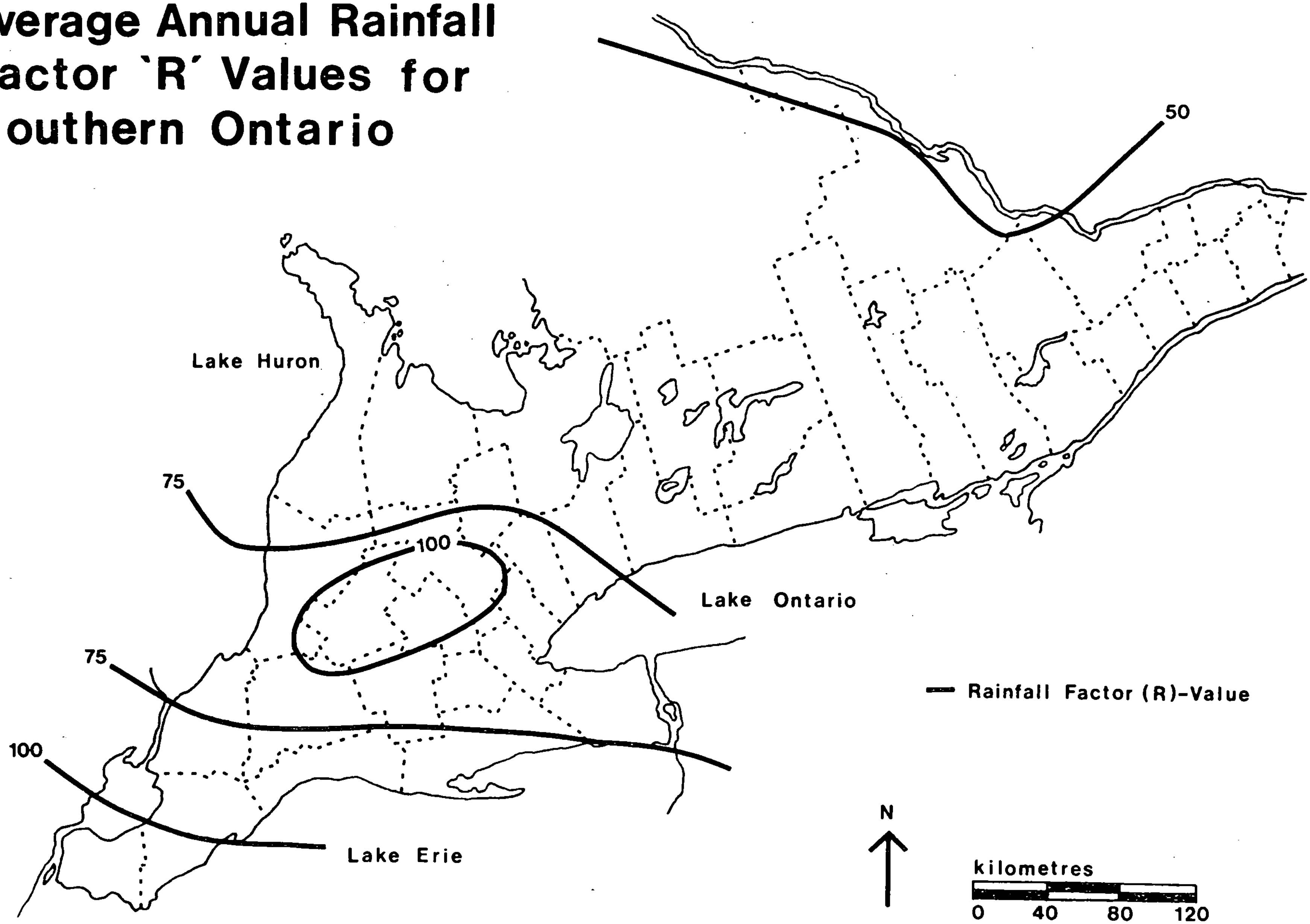
The wetland literature contains references to some hydrological values which are deliberately excluded from this evaluation. Here is a list of these values and purported values together with the reasons for excluding each.

3.5.1. Groundwater Discharge

Several authors have considered groundwater discharge to be a value of wetlands (O'Brien and Motts 1980, Ecologistics 1981, and

FIGURE 11

Average Annual Rainfall Factor `R´ Values for Southern Ontario



Ontario Scale Adapted From: Wall et al., 1983 others). However, the source of a wetland's water supply has no bearing on the relative value of a wetland. Thus, whether any wetland receives its water from seepage, from a stream or river, as rainfall or as general runoff appears to impart no particular value to the wetland. When a wetland exists because of "seepage" or "discharge" out of the ground then the discharge would still continue if the wetland were removed much in the same manner as when a wetland receives its water from a permanent stream - if the wetland were removed the stream would still continue to flow. Hence, value for discharge is zero.

3.5.2. Groundwater Recharge

With the exception of 3.2.2, groundwater recharge per se is excluded from measurement and evaluation because hydrologists do not agree amongst themselves that recharge of groundwater from wetlands is a general condition. In a real field situation it would not be possible most of the time to base scoring procedures on demonstrated principles. For Riverine and Lacustrine wetlands in particular, opinions, hunches and hypotheses would enter too often into the evaluation process.

3.5.3. Role of Organic Soils in Wetland Hydrology

The basic reason for not allocating any value to organic soils as "sponges" of water (and therefore as having value for base flow stabilization) requires explanation. Because organic soils have persistent high water contents, (i.e. organic soils can only be formed and persist under saturated conditions) there is limited extra storage available for additional water (Nixey 1977). Although there may be a slight drawdown of the water table during the summer as a result of heavy evapotranspiration, by late fall the organic soils are once again saturated. Virtually all of the water received during the spring melt has to drain off for there is no other place for it to go. Thus, the organic soils in themselves do not appear to provide for flow augmentation in downstream locations and the concept of organic soils acting as a "sponge" which has been advanced by many authors (e.g. Bertulli 1981) would therefore appear to be unfounded. In other words, organic soils do not give rise to stream flow; rather, these soils develop as a result of the same groundwater flow system which gives rise to the perennial stream flow.

What detention value such wetlands have is considered here only in the manner outlined under 3.2.1 of the hydrological component evaluation.

3.5.4. Surficial Geology

That surficial geology of lands immediately around a wetland as well as soils and geology under a wetland will have a major bearing on wetland hydrology is unquestionable. Thus, wetlands could have either more or less value depending on factors such as soil and rock permeability, presence of aquifers, thickness of materials and so on. However, all attempts to come to terms with these interrelated values proved frustrating and futile. Short of extensive drilling, excavation, etc. there is simply no easy way to draw sound hydrological conclusions from eyeball observations of surface features and surficial geology maps (e.g. from maps provided by Chapman and Putnam 1966). So, because of the certainty of introducing major erroneous misleading conclusions into the evaluation, surficial geology features are essentially omitted from evaluation.

3.5.5. The "Drag Effect" of Vegetation in Detaining Flood Waters

In comparison to the relative importance of surface area (basin area) the effect of vegetation in detaining flood waters is very small. As well, field experience in attempting to apply this variable to real wetlands has cast doubt on its accuracy and use.

4.0. SPECIAL FEATURES COMPONENT

4.1. RARITY AND/OR SCARCITY

4.1.1. Individual Wetlands

In many areas of southern Ontario, wetlands themselves have become rare features in the landscape. Southwestern Ontario in particular retains only a small fraction of its original wetlands. When wetlands are scarce they then have unique value for that reason alone.

Figure 12 divides southern Ontario into 14 areas. Each area represents a very broad physiographic unit (Chapman and Putnam 1967) plus ecological areas delineated by Hills (1960). The wetland scarcity rating is based on work by Reid et al. (1980).

To determine the rarity or scarcity of wetlands in different parts of Ontario, consult Figure 12.

4.1.2. Wetland Type Representation

Type representation is an assessment of the abundance of a particular type of wetland (marsh, swamp, fen, bog) in a region. The regions utilized for wetland type representation are the same Physiographic Units used in the preceding section on general wetland scarcity. Each of the 14 units is rated for the scarcity of the 4 wetland types, using the rating system developed by the Federation of Ontario Naturalists (Reid et al. 1980). While this may be considered a subjective treatment, it is the best available information at the present time since no comprehensive inventory has been completed.

The wetland types identified on the data sheet should be identical to those previously noted in the Biological Component (see 1.1.3). Wetland types are scored using Presence/Absence. (Minimum size of a wetland type is 0.5 ha).

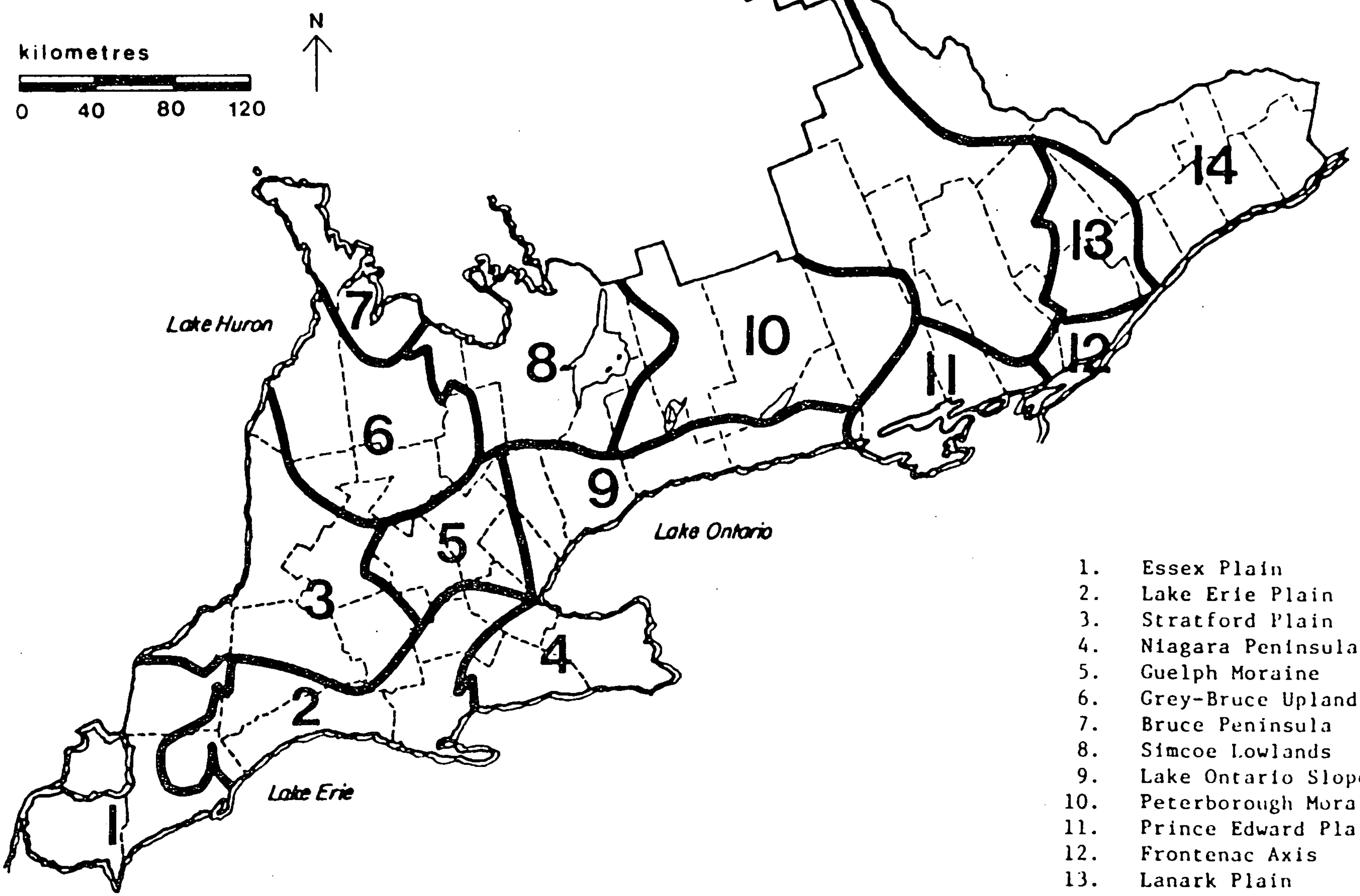
4.1.3. Individual Species

In this evaluation system, rarity and/or scarcity of species considers both animals and plants.

The causes of the 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 scarcity of suitable habitat for breeding, lack of migratory stopover areas, poor wintering habitat, predation, disease or pollution. Or, it may be due to the fact that the

FIGURE 12

Wetland Distribution Units of Southern Ontario



Source : Adapted From Reid et al., 1980

particular population is at the natural limits of its distribution range. Some species have always been rare for reasons known or not known. Whatever the causes of rarity, rare species are almost universally considered to be very important and worthy of protection efforts. Extinction, the final step for an endangered species, inevitably means the permanent loss of the species and the genetic material that it harbours. As well, many species have economic and social worth and the drastic reduction of their populations to the point of "rarity" reduces benefits accordingly.

Wetlands frequently support rare and unusual plant species by furnishing unique habitat. For example certain significant species such as the White Fringed Orchid (*Habenaria blephariglottis*), Snake Mouth Orchid (*Pogonia ophioglossoides*), the Grass Pink Orchid (*Calopogon pulchellus*) and the Pitcher Plant (*Sarracenia purpurea*) can often be found in fens or bogs that themselves are scarce in certain parts of Ontario. Wetlands are often all that is left of natural areas so they provide suitable habitat where there might otherwise be none. Hence, wetlands can be evaluated for their provision of permanent or transient habitat for rare species.

The rarity of species is evaluated by the degree of rarity; those species endangered provincially would rate higher than regional rarities. However, based on previous field testing, problems arise due to classification of species into certain categories of rarity (such as threatened or rare) and also it is often impractical to determine the kind of rarity (i.e. whether a species is a relict, at the limits of its range, regionally rare, etc.). Such problems produce too much subjectivity within the species rarity section. As a result, only endangered and various levels of significance are used as criteria for this section. For both provincially endangered and provincially significant species, lists are provided (Appendices IX through XIII) in order to reduce subjective decisions. All such lists should be viewed as "open-ended" and subject to revision.

In evaluating wetlands for rarity, it is recognized that rare species can seldom be identified during the course of field work associated with wetland evaluation. It takes considerable field work to determine rarity values of any wetland. Most wetlands that have species listed under rarity will be those that have been previously studied by others. This may result in many of the less studied wetlands scoring less than their true value due to a lack of knowledge.

In the special features component, a wetland may receive the 250 points for even a single value (e.g. nesting of an endangered species). As well, it may receive very high points for values such as provincially significant wintering habitat for deer. This point system is based on the principle that regardless of other values present, certain specific values are considered by society to be so significant as to at once generate high points for the wetland.

The presence of specific species of plants or animals should be noted during field visits, but most information, if any exists, will be found in reports of various types. The field worker should examine scientific papers, Environmentally Sensitive Area studies, government reports from MNR and Conservation Authorities, International Biological Program reports, and any other available sources. In all cases a species is to be listed only once. For example, an endangered species cannot also be considered regionally significant.

A blank section in this Component may indicate a lack of knowledge, as opposed to a lack of special features.

4.1.3.1. Breeding Habitat for an Endangered Animal or Plant Species

No species can survive for long without suitable habitat. It is the actual presence of the species itself which is the best indicator that a wetland is providing the needed habitat. Such wetlands automatically receive very high scores. Endangered species are those listed under the Ontario Endangered Species Act 1971 (Appendix IX).

4.1.3.2. Traditional Migration or Feeding Habitat for an Endangered Animal Species

The survival of endangered migratory species is vitally dependent during migration upon the presence of suitable habitat along the migration route where they can find food and shelter. Such traditional migration areas, in addition to traditional feeding areas (not necessarily breeding habitat), are very valuable and are scored accordingly.

Note that in this section, an endangered species does not have to be documented as a resident breeder. If a species is known to traditionally use a wetland as a feeding area or during migration it should be assessed in this section.

4.1.3.3. Breeding or Feeding Habitat for a Provincially Significant Animal Species

Some wetlands provide breeding and/or feeding habitat for provincially significant animal species, as opposed to endangered species. These wetlands are valuable, but less so than those harbouring endangered species.

Provincial significance designation may be a result of provincial rarity where a species is a relict, at the limits of its range, occurs in low numbers over a wide area, occurs in a small area but is common locally, or is considered threatened. The incidental observation of a migrating species does not give the wetland status as a breeding or feeding habitat of provincial significance.

Lists of provincially significant animal species are provided in Appendices X to XIII. These lists have been prepared using the COSEWIC (Committee on the Status of Endangered Wildlife in Canada) 1983 national list, existing reports by various authors such as Cook (1970), Goodwin (1976), James et al. (1976) and McAllister and Gruchy (1976), and opinions of Provincial government biologists. Lists have been updated following review by various government and non-government experts.

4.1.3.4. Provincially Significant Plant Species

These species are designated as provincially significant for the same reasons as the preceding animal species. Provincially significant plants are listed as provincially rare in Argus and White (1977, 1982).

4.1.3.5. Regionally Significant Species

Regional significance is based on the same criteria as outlined in 4.1.3.3, but on a more regional or local level. Certain species may be regionally rare or uncommon, but quite common in other parts of southern Ontario. The presence of such species in a certain wetland adds to the value of that wetland, although much less than the presence of a provincially significant species.

Regional significance is to be deduced from ESA studies, scientific papers, MNR and Conservation Authority reports, and other similar publications. Nature Clubs (Appendix I) may also have information on regionally rare species.

Regionally rare wetlands more often than not contain regionally rare species. For example, Alfred Bog contains numerous "regionally rare" plants such as pitcher plants and orchids.

In all cases list the endangered, provincially significant or regionally significant species in the spaces provided. Also state the source(s) of information, i.e. full citation of the report or paper, or name and address for personal communications.

4.2. SIGNIFICANT FEATURES AND/OR FISH AND WILDLIFE HABITAT

To qualify for inclusion in this list a feature or phenomenon must be deemed to have exceptional importance in the public mind. Obviously, many more variables could be added since one can always find some person who as an individual may attach much importance to some aspect of nature. Only the "truly significant" in the general or public sense would qualify for inclusion.

Not all wetlands are alike. Indeed, some wetlands due to their geographical location or to the unusual nature of their habitat may have certain special values which are not normally associated with the large majority of Ontario's wetlands. It is therefore of importance to record any known unusual attributes so that we can gain a fuller appreciation of the value of the wetland in comparison with other wetlands. The following sections describe 7 significant habitats or features (4.2.1 through 4.2.7).

4.2.1. Nesting of Colonial Waterbirds

In comparison to most other species of birds, colonial waterbirds represent a special type of secondary and tertiary productivity and it is felt that these species deserve special treatment separate from the biological component. The nesting of these birds is localized, of special interest to many people, and the colonies are quite vulnerable to destruction. It is considered useful, therefore, to recognize this value directly as a significant special feature. Some wetland areas, while not being utilized for nesting, are traditionally used as feeding areas by the members of a nearby colony.

Colonial waterbirds are terns, gulls, Double-crested Cormorants, Black-crowned Night Herons and Great Blue Herons. Information on colonial waterbirds will come from MNR officials, local residents, literature, the Long Point Bird Observatory Heron Survey, and the Canadian Wildlife Service.

4.2.2. Winter Cover for Wildlife

The value of certain wetlands in providing winter cover is a specialized value and is recognized in this section. Two provincially important species, white-tailed deer and moose, depend on wintering habitat which often includes swamp wetlands. These "deer yard" wetlands are recognized under three levels of significance (provincial, regional and local).

Other wildlife species can more readily survive in an area if suitable winter cover exists in the wetland. Good cover for other wildlife species would include the presence of conifers in dense stands or mixtures of evergreens with deciduous trees, shrubs, etc. If in Ring-necked Pheasant range, i.e. in Southwestern Ontario, a cattail marsh with or without low shrubs or wooded borders would provide good winter cover.

MNR District and/or Regional Offices must be contacted to determine the significance of a wetland as winter cover for deer or moose.

4.2.3. Waterfowl Staging

It is well known that certain wetlands have exceptionally high value as places where large numbers of waterfowl concentrate to feed and rest during migration. Long Point and Lake St. Clair are two such outstanding areas. These wetlands are of critical importance on a national level. Other wetlands provide the same type of value on a provincial or regional level. Many of the Great Lakes shoreline marshes would be considered as staging areas. MNR District and Regional Offices and the Canadian Wildlife Service should be consulted for areas of regional, provincial or national importance.

4.2.4. Waterfowl Production

That wetlands are of critical importance to nesting waterfowl is an indisputable fact. Some wetlands, because of the number of breeding waterfowl and/or the uncommonness of certain species, are worthy of being recognized as significant waterfowl production areas. This recognition goes beyond the evaluation of relevant variables found in the Biological Component.

Significant areas in Ontario for waterfowl production should be determined by consulting District and Regional offices of the MNR, as well as the Canadian Wildlife Service. Most wetlands in Ontario would be categorized as being no more than locally important. The presence of one or a few nesting pairs of waterfowl on a wetland would not constitute significance. On the other hand, the presence of 200 or more pairs of nesting Redheads in the Walpole Island marshes of Lake St. Clair could be termed provincially significant.

4.2.5. Migratory Passerine and/or Shorebird Stopover Area

This value is recognized because certain wetlands along the north shores of Lakes Erie and Ontario in particular, are locations where passerines and/or shorebirds stop to rest and feed during migration.

Locations where migratory bird species frequently interrupt migration to rest for short periods of time are called migratory bird stopover areas. All wetlands will have some significance as migratory bird stopover areas. Among the most significant areas for passerine species are the points of land along the north shores of Lakes Erie and Ontario. Certain inland wetlands can also be singled out as having more than average importance. "High significance" as migratory passerine stopover areas would be applicable to places such as Point Pelee, Rondeau, Long Point and Presqu'ile. "No significance" would apply to the overwhelming majority of Ontario's wetlands. For shorebirds, examples of areas of high significance as stopover areas (spring or fall) are Long Point, Presqu'ile and Cootes Paradise. Again check with MNR and CWS etc. before finalizing an answer to this variable.

4.2.6. Significance for Fish Spawning and Rearing

In many instances Lacustrine wetlands can be more valuable for fish spawning and/or rearing than for waterfowl staging. On a lake or water system basis, and sometimes on a regional basis, documented knowledge can be utilized to highlight significant fish spawning or rearing areas. These wetlands may be significant because of the large numbers of fish involved, or because of the presence of a few individuals of a key species. An example of the first may be a large concentration of spawning Northern Pike and of the second, spawning by a few individual Muskellunge.

MNR District and Regional offices must be approached to provide the necessary information and to make the judgement for this section.

4.2.7. Unusual Geological or other Surficial Features

Glaciated terrain often has been associated with certain wetland-related features such as deltas, kames and sink holes. They may be of such a nature or conformity as to be seen as an integral part of the value of the wetland. In many instances the features noted, such as a marl marsh or a kettle bog in southwestern Ontario, may be regionally rare or "one of a kind."

ESA studies, MNR and Conservation Authority reports and other sources of information should be examined. In addition, people familiar with the wetlands of a region should be approached to utilize their knowledge.

4.3. ECOLOGICAL AGE

The ecological age of a wetland is an important indicator of habitat status. Age in this context refers to the approximate time required to restore the area to its present condition should it be destroyed. This assessment assumes that the desirability of preserving a wetland can be measured in part by the amount of time involved and the cost of replacing it.

Of the four wetland types, bogs generally represent the greatest state of ecological age, followed by fens, swamps and finally marshes. As a community ages, the productivity and diversity of the wetland decreases from the dynamic condition of early growth. Regardless of this, animal and plant life that depend on a certain wetland type, such as a bog, will always require the particular habitat afforded only by a bog. Destruction of a bog community would leave these species without habitat to sustain them. Since the replacement of a bog takes thousands of years, these species would be locally extirpated. In contrast, a marsh could re-establish and provide marsh habitat in a matter of years or decades. Ecological age is, therefore, evaluated by the wetland type.

Information relevant to this variable can be obtained from 1.1.3 and 4.1.2.

INVESTIGATORS

Enter the name(s) of the person(s) who made and recorded the field observations and who conducted the necessary literature and background investigations.

AFFILIATION

Enter the name of the employer or the agency for which the evaluator is recording the information.

DATE

Enter the date or dates on which the field observations were made.

ESTIMATED TIME DEVOTED TO COMPLETING THE FIELD SURVEY

Estimate the amount of time that was devoted to securing the field information required for each wetland. Time involved in driving to and from the wetland should not be counted.

WEATHER CONDITIONS

Enter general information regarding weather conditions on the day(s) of the field visit, and conditions for the summer season in general (i.e. hot, dry year).

PART II. SCORING

1.0. BIOLOGICAL COMPONENT

1.1. PRODUCTIVITY VALUES

1.1.1. Growing Degree-Days

Evaluation:

Growing Degree-Days	Points
<2800	= 4
2800 to 3200	= 8
3200 to 3600	= 14
>3600	= 20

(Maximum possible = 20)

Wetland complexes should be evaluated by determining the GDD's at the approximate centre of the complex.

1.1.2. Soils

Evaluation:

Clays, loams or silts	% of area x 10
Organic	% of area x 6
Undesignated	% of area x 0

(Maximum possible = 10)

In wetland complexes the evaluator should aim at determining the fraction of area occupied by the 3 categories for the complex as a whole.

Example of scoring: If a wetland has 20% Clays and 80% Organic soils, the scoring would be (20% x 10) + (80% x 6) = 2+4.8 = 6.8 or 7.

1.1.3. Type of Wetland

Evaluation:

Bog	% of area x 4
Fen	% of area x 8
Swamp	% of area x 12
Marsh	% of area x 20

(Maximum possible = 20)

In wetland complexes the percent of area occupied by each wetland type (in all individual wetlands of the complex) should be the basis for the evaluation of type of wetland.

1.1.4. Site

Evaluation:

- Isolated	% of area x 2
- Palustrine (permanent or intermittent outflow)	% of area x 4
- Riverine	% of area x 8
- Riverine (at rivermouth)	% of area x 10
- Lacustrine (at rivermouth)	% of area x 10
- Lacustrine (on enclosed bay)	% of area x 6
- Lacustrine (exposed to lake)	% of area x 4

(Maximum possible = 10)

In evaluating wetland complexes for site, the same considerations apply as in 1.1.3 above.

1.1.5. Nutrient Status of Surface Water

Evaluation:

Total Dissolved Solids (T.D.S.) after temperature conversion

<100	mg/l	= 0
100 to 500	mg/l	= 20
501 to 1,500	mg/l	= 10
>1,500	mg/l	= 0

Note: If a reading cannot be obtained, score 0.

(Maximum possible for Nutrient Status of Surface Water = 20)

(Maximum possible for 1.1, PRODUCTIVITY VALUES = 80)

1.2. DIVERSITY VALUES

1.2.1. Number of Wetland Types

Evaluation:

Number of Types

One	= 3
Two	= 6
Three	= 9
Four	= 12

(Maximum possible = 12)

1.2.2. Vegetation Communities

Evaluation:

Give two points for each community with one form, 3 for each area with two forms, and four for each area with three or more forms.

In wetland complexes, vegetation communities in each wetland in the complex should be mapped and scored. In other words, all the wetlands in the complex should be treated as one for purposes of evaluating vegetation communities.

Note: A wetland having many diverse vegetation communities may potentially obtain more than 30 points. Do not exceed 30!

(Maximum allowable = 30)

1.2.3. Diversity of Surrounding Habitat

Evaluation:

- Ten or more kinds of surrounding habitat including forested land	10
- Six to nine kinds of surrounding habitat including forested land	7
- Two to five kinds of surrounding habitat including forested land	4
- Surrounding habitat made up of row crop agriculture	1

In the case of individual wetlands this variable pertains to all uplands within 1.5 km of the wetland; in wetland complexes, surrounding habitat pertains to uplands between and among the different wetlands of the complex as well as lands up to 1.5 km from the edge of any wetland of the complex.

(Maximum possible = 10)

1.2.4. Proximity to Other Wetlands

Evaluation:

In the case of individual wetlands this variable pertains to all wetlands within 1.5 km. In the case of wetland complexes proximity pertains to wetlands within the complex; score the 2 most "closely" connected wetlands (i.e. most points)

i)	Hydrologically connected by surface water to other wetlands (different dominant type) or open water within 1.5 km.	10
ii)	Hydrologically connected by surface water to other wetlands (same dominant type) within 0.5 km.	10
iii)	Hydrologically connected by surface water to other wetlands (different dominant type) or open water body from 1.5 to 4 km away.	6
iv)	Hydrologically connected by surface water to other wetlands (same dominant type) from 0.5 to 1.5 km away.	6
v)	Within 0.75 km of other wetlands (different dominant type) or open water body, but not hydrologically connected by surface water.	6
vi)	Within 1 km of other wetlands, but not hydrologically connected by surface water.	2
vii)	No wetland within 1.5 km.	0

(Maximum possible = 10)

1.2.5. Interspersion

Evaluation:

Type 1 = 6
Type 2 = 12
Type 3 = 20
Type 4 = 28

In evaluating wetland complexes for interspersion one should examine the degree of interspersion in each wetland in the complex, then draw a conclusion as to which interspersion type might best describe the complex as a whole. A subjective decision is required.

(Maximum possible = 28)

1.2.6. Open Water Types

Evaluation:

No open Water	=	0
Type 1	=	8
Type 2	=	8
Type 3	=	14
Type 4	=	20
Type 5	=	30
Type 6	=	8
Type 7	=	14
Type 8	=	3

(Maximum possible = 30)

(Maximum possible for 1.2, DIVERSITY VALUES = 120)

1.3. SIZE (BIOLOGIAL COMPONENT) EVALUATION TABLE

No. of Hectares	Total Diversity Values 11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-120
<2	4	7	10	16	26	35	42	48	50
2 - 4	5	8	12	17	28	38	44	49	50
5 - 8	5	9	13	21	30	40	46	50	50
9 - 12	6	10	15	22	32	42	48	50	50
13 - 17	6	11	16	23	34	44	50	50	50
18 - 23	6	12	18	24	36	46	50	50	50
24 - 28	7	13	19	26	38	48	50	50	50
29 - 37	7	14	21	27	41	49	50	50	50
38 - 49	7	14	22	29	43	50	50	50	50
50 - 62	8	15	23	31	45	50	50	50	50
63 - 81	8	16	24	33	46	50	50	50	50
82 - 105	9	17	25	35	47	50	50	50	50
106 - 137	9	18	26	37	48	50	50	50	50
138 - 178	10	18	27	39	49	50	50	50	50
179 - 233	10	19	28	41	50	50	50	50	50
234 - 302	11	19	29	43	50	50	50	50	50
303 - 393	11	20	30	45	50	50	50	50	50
394 - 511	11	20	31	46	50	50	50	50	50
512 - 665	12	21	32	47	50	50	50	50	50
666 - 863	12	21	33	48	50	50	50	50	50
864 - 1123	13	22	35	48	50	50	50	50	50
1124 - 1460	13	22	36	49	50	50	50	50	50
1461 - 1898	14	23	37	49	50	50	50	50	50
1899 - 2467	14	24	39	50	50	50	50	50	50
>2467	15	25	40	50	50	50	50	50	50

(Maximum possible for 1.3, SIZE (Biological Component) = 50)

(Maximum possible for 1.0, BIOLOGICAL COMPONENT = 250)

2.0. SOCIAL COMPONENT

2.1. RESOURCE PRODUCTS WITH CASH VALUE

Evaluation:

2.1.1. Timber (lumber and firewood)

(1)	51 to 100% of wetland area has mature trees (>10 cm dbh, >25% cover)	20
(2)	10 to 50% of wetland area has mature trees (as above)	10
(3)	Wetland has few, immature, or no trees	0

(Maximum possible = 20)

2.1.2. Wild Rice

(1)	Present	10
(2)	Absent	0

(Maximum possible = 10)

2.1.3. Commercial Fish (Bait Fish and/or Coarse Fish)

(1)	Fish harvested from the wetland	30
(2)	Abundant during at least part of the year	10
(3)	Not abundant or only occasional	5
(4)	Habitat not suitable for fish	0

(Maximum possible = 30)

2.1.4. Bullfrogs

(1)	Present	2
(2)	Absent	0

(Maximum possible = 2)

2.1.5. Snapping Turtles

(1)	Present	2
(2)	Absent	0

(Maximum possible = 2)

2.1.6. Furbearers

(1) Of the 4 furbearers (muskrats, raccoon, beaver and mink), at least 2 are present either permanently or from time to time	15
(2) Of the 4 above furbearers, at least 1 is present	10
(3) A furbearer other than any of the above is present	3

(Maximum possible = 15)

(Maximum allowable for 2.1, RESOURCE PRODUCTS WITH CASH VALUE = 60)

2.2. RECREATIONAL ACTIVITIES

Evaluation:

	Type of Wetland Associated Use			
Intenstity of Use	Hunting	Nature Appreciation or Study	Fishing	Canoeing/Boating
High	40	40	20	20
Moderate	20	20	12	12
Low	8	8	5	5
None Known	0	0	0	0
Not Possible	0	0	0	0

(Maximum allowable for 2.2, RECREATIONAL ACTIVITIES = 70)

2.3. AESTHETICS

Evaluation:

2.3.1. Landscape Distinctness

(1) Clearly distinct	5
(2) Indistinct	0

(Maximum possible = 5)

2.3.2. Absence of Human Disturbances

2.3.2.1 <u>Level of Disturbance</u>

(1)	Human disturbances absent or nearly so	20
(2)	One or several localized disturbances	15
(3)	Moderate disturbance; localized water pollution	10
(4)	Impairment of natural quality intense in some areas or severe localized water pollution	5
(5)	Extremely intense disturbance or water pollution severe and widespread	0

(Maximum possible = 20)

2.3.2.2. <u>Types of Disturbance</u>
(not scored)

(Maximum possible for 2.3, AESTHETICS = 25)

2.4. EDUCATION AND PUBLIC AWARENESS

Evaluation:

2.4.1. <u>Educational Uses</u>

(1)	Frequent	10
(2)	Infrequent	5
(3)	None known	0

(Maximum possible = 10)

2.4.2. <u>Facilities and Programs</u>

(1)	Staffed interpretation center	20
(2)	Trails with signs or brochures	10
(3)	No facilities or programs	0

(Maximum possible = 20)

2.4.3. <u>Research and Studies</u>

(1)	Research papers published	5
(2)	Reports written	3
(3)	None of the above	0

(Maximum possible = 5)

(Maximum possible for 2.4, EDUCATION AND PUBLIC AWARENESS = 35)

2.5. PROXIMITY TO URBAN AREAS

Evaluation:

(1)	In an urban or suburban area	20
(2)	< 10km from a population center greater than 10,000	16
(3)	10 to 60km from a population center greater than 10,000	10
(4)	Isolated or relatively remote	2

(Maximum possible for 2.5, PROXIMITY TO URBAN AREAS = 20)

2.6. OWNERSHIP/ACCESSIBILITY EVALUATION TABLE

	Public land with unrestricted activities	Public land with restricted activities	Private but open to the public for limited activities	Private Club; closed to public	Private or Private and Posted
(1) Easily accessible at most times by road or waterway	20	16	10	7	5
(2) Easily accessible only at certain times of the year	18	16	9	6	4
(3) Limited accessibility and moderate effort required	16	14	8	6	4
(4) Access difficult, requires extended effort due to distance from roads, navigable waterways or isolated geographical position	14	12	7	5	3

(Maximum possible for 2.6, OWNERSHIP/ACCESSIBILITY = 20)

Scoring example: If Wetland A is easily accessible at most times and 60% is public land with unrestricted activities, score 20 x 60% = 12 and if 40% of Wetland A is Private but open to the public for limited activities then score 10 X 40% = 4. Therefore, Total Ownership/Accessibility score is 12 + 4 = 16.

2.7 SIZE (SOCIAL COMPONENT) EVALUATION TABLE

No. of Hectares	Total Size-Dependent Score*									
	2-15	16-30	31-45	46-60	61-75	76-90	91-105	106-120	121-135	136-150
<2	1	2	4	8	10	12	14	14	14	15
2 - 4	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 - 23	4	5	8	11	15	16	16	17	17	18
24 - 28	4	6	9	12	15	16	17	17	18	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

(Maximum possible for 2.7, SIZE (Social Component) = 20)

* The size-dependent social features are Resource Products (60), Recreational Activities (70) and Proximity to Urban Areas (20) for a total of 150.

(Maximum possible for 2.0, SOCIAL COMPONENT = 250)

3.0. HYDROLOGICAL COMPONENT

3.1. EFFECT OF ADJOINING LARGE WATER BODY (Not Scored)

(1) Wetland located on one of the 5 large rivers (Go to Section 3.3)

(2) Wetland bordering on one of the Great Lakes (Go to Section 3.3)

(3) Wetland not located as above. (Go to Section 3.2)

3.2. FLOW STABILIZATION (All wetlands except those bordering on the Great Lakes or the 5 large rivers)

3.2.1. Detention Due to Surface Area

3.2.1.1. and 3.2.1.2. (combined)
Size of Catchment Basin above Wetland Outflow in relation to total size of all wetlands, reservoirs and lakes draining into the wetland

Evaluation: FIRST STEP

Size of Catchment Basin (in sq. km)	Total size of all lakes, reservoirs and wetlands draining into the wetland (in sq. km)										
	<2	2-5	6-10	11-20	21-40	41-80	81-160	161-320	321-640	641-1280	>1,280
<2	10										
2-5	30	10									
6-10	50	30	10								
11-20	70	50	30	10							
21-40	90	70	50	30	10						
41-80	110	90	70	50	30	10					
81-160	110	110	90	70	50	30	10				
161-320	110	110	110	90	70	50	30	10			
321-640	110	110	110	110	90	70	50	30	10		
641-1,280	110	110	110	110	110	90	70	50	30	10	
1,281-2,560	110	110	110	110	110	110	90	70	50	30	10
2,561-5,120	110	110	110	110	110	110	110	90	70	50	30
5,121-10,240	110	110	110	110	110	110	110	110	90	70	50
10,241-20,480	110	110	110	110	110	110	110	110	110	90	70
20,481-40,960	110	110	110	110	110	110	110	110	110	110	90
>40,960	110	110	110	110	110	110	110	110	110	110	110

(Maximum possible = 110; Minimum possible = 10)

3.2.1.3. Size of Adjoining Lake (Lacustrine wetlands only)

Evaluation: SECOND STEP If the wetland is Lacustrine, discount size of the adjoining lake.

Size of adjoining lake (hectares)			
<128	subtract	0	from above total
128-256	"	1	"
257-512	"	2	"
513-1,026	"	4	"
1,027-2,054	"	8	"
2,055-4,110	"	16	"
4,111-8,220	"	32	"
8,221-16,442	"	64	"
>16,442	"	110	"

(Maximum possible = 0; minimum possible = -110)

3.2.1.4. Size of Adjoining River (Riverine wetlands only)

Evaluation: This variable is not scored.

3.2.1.5. Location and Size of Detention Areas (Lakes, Reservoirs and Wetlands) within 30 km above and below the wetland.

Evaluation: THIRD STEP Discount the effect of detention areas (lakes, reservoirs or wetlands) located above or below the wetland.

Important: Using table, evaluate each and every detention area separately. It is the sum total that is entered in the Evaluation Record. This total will either be 0 or a negative number. Minimum Allowable Total = -50

In the event that one of the 5 large rivers (see Section 3.1) is located within 30 km of the wetland exit, then the effect of the river is assessed using the sixth (last) vertical column of the following table (greater than 16,384 ha).

Distance (above or below the wetland)	Size of the lake, reservoir or wetland (above or below the wetland) (in hectares) <8	8-144	145-1,024	1,025-4,096	4,097-16,384	>16,384
<5 km	-2	-5	-17	-28	-39	-50
5-10 km	-1	-4	-14	-24	-33	-42
11-15 km	0	-3	-8	-16	-24	-34
16-20 km	0	-2	-6	-14	-20	-26
21-25 km	0	-1	-3	-8	-12	-18
26-30 km	0	0	-1	-4	-7	-10
nearby detention areas absent	0	0	0	0	0	0

(Maximum possible = 0; minimum allowable = -50)

3.2.1.6. Land Use along River or Stream Shoreline Below the Wetland

(Palustrine and all Riverine wetlands except those located along the 5 large rivers).

Evaluation: FOURTH STEP Discount land use on or above the river or stream shoreline for 20 km below the wetland exit.

(1) If outflow river or stream exits into a deep ravine, significant flood damage to property is not likely to occur -15

(2) If not as above, but a village, town or urban area is located within 20 km of wetland exit on outflow river/stream 0

(3) If not as above, but if actively farmed agricultural land borders onto outflow river or stream and where

length of agricultural border =	< 1 km	-10
(sum of shoreline on both	1-3 km	- 5
sides of river within	4-8 km	- 2
20 km)	> 8 km	0

(4) If not as above, eg. some lands bordering onto outflow river or stream are forested or abandoned by agriculture, or outflow enters another wetland, lake, etc. -15

(Maximum possible = 0; minimum possible = -15)

(Minimum total allowable following FOURTH STEP = 0)

Example for scoring Land Use (3.2.1.6)

Wetland outflow enters a semi-large lake (approximately 10,000 ha) 3 km below wetland. Land use is assessed along both sides of the 3 km distance above the downstream lake. If there is no ravine and no town present, and actively farmed agricultural land borders the outflow along both sides (i.e. 3 km x 2 = 6 km), the score for land use is -2.

3.2.1.7. Size (Hydrological Component)

Evaluation: FIFTH STEP. Add size of the wetland.

Total Wetland Size (hectares)	Amount to be added to total score at end of FOURTH STEP	
<2	Add	1
2 - 4	"	3
5 - 8	"	6
9 - 12	"	9
13 - 17	"	12
18 - 23	"	14
24 - 28	"	16
29 - 37	"	18
38 - 49	"	20
50 - 62	"	22
63 - 81	"	24
82 - 105	"	26
106 - 137	"	28
138 - 178	"	30
179 - 233	"	32
234 - 302	"	34
303 - 393	"	36
394 - 511	"	38
>511	"	40

(Maximum possible = 40; minimum possible = 1)

(Maximum possible for 3.2.1, Detention Due to Surface Area = 150; minimum possible = 1)

3.2.2. Flow Augmentation (Palustrine wetlands only)

Evaluation:

Size of Catchment basin in sq. km (includes wetland)	Wetland Area as a % of Catchment Basin Size										
	<3	3-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
<1	4	6	8	10	13	16	19	21	24	27	30
1 - 3	8	12	20	24	28	32	34	36	38	40	40
4 - 9	12	25	35	38	40	40	40	40	40	40	40
10 - 27	16	35	40	40	40	40	40	40	40	40	40
28 - 81	20	38	40	40	40	40	40	40	40	40	40
82 - 243	24	40	40	40	40	40	40	40	40	40	40
244 - 729	28	40	40	40	40	40	40	40	40	40	40
730 - 2,187	31	40	40	40	40	40	40	40	40	40	40
2,188 - 6,561	34	40	40	40	40	40	40	40	40	40	40
6,562 - 19,683	37	40	40	40	40	40	40	40	40	40	40
>19,683	40	40	40	40	40	40	40	40	40	40	40

(Maximum possible for 3.2.2, Flow Augmentation = 40)

(Maximum possible for 3.2, FLOW STABILIZATION = 190)

3.3. WATER QUALITY IMPROVEMENT (All wetlands)

3.3.1. Short Term Removal of Nutrients from Surface Water

3.3.1.1. Site Type

Note: Assess using dominant site type.

Evaluation:

Isolated	1
Palustrine with permanent or intermittent outflow	2
Riverine	4
Riverine (at rivermouth)	5
Lacustrine (at rivermouth)	5
Lacustrine (on enclosed bay)	3
Lacustrine (exposed to lake)	2

(Maximum possible = 5)

3.3.1.2. Actual Wetland Area Dominated by Robust Emergents and Submergents

Evaluation:

<5	0
5 - 50	2
51 - 100	4
101 - 250	6
251 - 500	8
501 - 1000	9
>1000 hectares	10

(Maximum possible = 10)

3.3.1.3. Land Use in Catchment Basin

Evaluation:

(1) Mainly agriculture and/or urban	10
(2) Roughly 40-60% agriculture; remainder forested or abandoned agriculture	7
(3) Mainly forested and/or less than 40% agriculture	3

(Maximum possible = 10)

(Maximum possible for 3.3.1, Short Term Removal of Nutrients from Surface Water = 25)

3.3.2. Long Term Nutrient Trap

Evaluation:

(1)	Wetland located on an active delta	10
(2)	Wetland rivermouth but without obvious delta	7
(3)	Wetland with organic soils occupying 50% or more of the area	6
(4)	Wetland with organic soils occupying less than 50% of the area (i.e. mainly mineral or undesignated soils)	4

(Maximum possible = 10)

(Maximum possible for 3.3, WATER QUALITY IMPROVEMENT = 35)

3.4. EROSION CONTROL

3.4.1. Erosion Buffer (Lacustrine and Riverine wetlands only)

Evaluation:

3.4.1.1. Riverine Wetlands (shoreland and flood plain)

Principal Vegetation Form	
(1) Trees or Shrubs	15
(2) Emergents	10
(3) Non-vegetated or nearly so	0

(Maximum possible = 15)

3.4.1.2. Lacustrine Wetlands

Principal Vegetation Form	
(1) Trees or Shrubs	15
(2) Emergents	13
(3) Submergents & Floating	8
(4) Non-vegetated or nearly so	0

(Maximum possible = 15)

3.4.1.3. Fetch (Lacustrine wetlands or Riverine wetlands on any of the 5 large rivers)

Maximum distance	
(1) barrier beach present	0
(2) <2 km	1
(3) 2 to 8 km	3
(4) >8 km	5

(Maximum possible = 5)

(Maximum allowable for 3.4.1, Erosion Buffer = 20)

3.4.2. Sheet Erosion (For all except Lacustrine wetlands)

Evaluation:

Wetland Size (ha)	R FACTOR VALUE <50	50-75	75-100	>100
<2	0	1	2	2
2-5	1	1	2	3
6-10	1	1	3	3
11-15	1	2	3	4
16-20	2	2	3	4
>20	2	3	4	5

(Maximum possible = 5)

(Maximum possible for 3.4, EROSION CONTROL = 25)

(Maximum possible for 3.0, HYDROLOGICAL COMPONENT = 250)

4.0. SPECIAL FEATURES COMPONENT

4.1. RARITY AND/OR SCARCITY

4.1.1. Individual Wetlands

Evaluation:

Unit Number	Physiographic Unit	Wetland Scarcity*
1	Essex Plain	35
2	Lake Erie Plain	35
3	Stratford Plain	35
4	Niagara Peninsula	35
5	Guelph Moraine	20
6	Grey-Bruce Uplands	20
7	Bruce Peninsula	5
8	Simcoe Lowlands	20
9	Lake Ontario Slope	20
10	Peterborough Moraine	5
11	Prince Edward Plain	20
12	Frontenac Axis	5
13	Lanark Plain	5
14	Eastern Moraine	20

*Wetland Scarcity is ranked from 5 to 35, with 35 representing very scarce and 5 representing not scarce.

(Maximum possible = 35)

4.1.2. Wetland Type Representation

Note: Score Presence/Absence of a wetland type. Example: a wetland gets maximum points if a rare wetland type is present (minimum size 0.5 ha).

Evaluation:

		Type Representation*			
Unit Number	Physiographic Unit	Marsh	Swamp	Fen	Bog
1	Essex Plain	0	10	20	20
2	Lake Erie Plain	0	10	20	20
3	Stratford Plain	20	0	20	20
4	Niagara Peninsula	10	0	20	20
5	Guelph Moraine	20	0	20	20
6	Grey-Bruce Uplands	20	0	20	20
7	Bruce Peninsula	20	0	10	20
8	Simcoe Lowlands	10	0	20	20
9	Lake Ontario Slope	10	0	20	20
10	Peterborough Moraine	10	0	20	20
11	Prince Edward Plain	0	10	20	20
12	Frontenac Axis	10	0	20	10
13	Lanark Plain	20	0	20	20
14	Eastern Moraine	20	0	20	20

(Maximum possible = 20)

* Type Representation:

20 = area of that type accounts for less than 10% of the total wetland area of the Physiographic Unit.
10 = area of that type accounts for between 10 and 50% of the total wetland area of the Physiographic Unit.
0 = area of that type accounts for more than 50% of the total wetland area of the Physiographic Unit.

4.1.3. Individual Species

4.1.3.1. Breeding Habitat for an Endangered Animal or Plant Species

Evaluation:

One or more species 250

(Maximum possible = 250)

4.1.3.2. Traditional Migration or Feeding Habitat for an Endangered Animal Species

Evaluation:

(1) One species	150
(2) Two or more species	200

(Maximum possible = 200)

4.1.3.3. Breeding or Feeding Habitat for a Provincially Significant Animal Species

Evaluation:

(1) One species	100
(2) Two or more species	150

(Maximum possible = 150)

4.1.3.4. Provincially Significant Plant Species

Evaluation:

(1) One species	100
(2) Two or more species	150

(Maximum possible = 150)

4.1.3.5. Regionally Significant Species

Evaluation:

(1)	One species	10
(2)	Two species	20
(3)	Three or more species	30

(Maximum possible = 30)

(Maximum allowable for 4.1.3, Individual Species = 250)

(Maximum allowable for 4.1, RARITY AND/OR SCARCITY = 250)

4.2. SIGNIFICANT FEATURES AND/OR FISH AND WILDLIFE HABITAT

4.2.1. Nesting of Colonial Waterbirds

Evaluation:

(1) Currently nesting	15
(2) Known to have nested within past 5 years	7
(3) Active feeding area	3
(4) None known	0

(Maximum possible = 15)

4.2.2. Winter Cover for Wildlife

Evaluation:

(1) Provincial significance for Deer or Moose	100
(2) Regional significance for Deer or Moose	50
(3) Local significance for Deer or Moose	10
(4) Good winter cover for other species	10
(5) Poor winter cover	1

(Maximum possible = 100)

4.2.3. Waterfowl Staging

Evaluation:

(1) National significance	150
(2) Provincial significance	100
(3) Regional significance	50
(4) Local or no significance	0

(Maximum possible = 150)

4.2.4. Waterfowl Production

Evaluation:

(1) Provincial significance	50
(2) Regional significance	25
(3) Local significance	5
(4) Little or no significance	0

(Maximum possible = 50)

4.2.5. Migratory Passerine and/or Shorebird Stopover Area

Evaluation:

(1) High significance	15
(2) No significance	0

(Maximum possible = 15)

4.2.6. Significance for Fish Spawning and Rearing

Evaluation:

(1) Regional significance	50
(2) Present	15
(3) Unknown	0
(4) Not possible	0

(Maximum possible = 50)

4.2.7. Unusual Geological or other Surficial Features

Evaluation:

(1) Present	15
(2) Poorly expressed or absent	0

(Maximum possible = 15)

(Maximum allowable for 4.2, SIGNIFICANT FEATURES AND/OR WILDLIFE HABITAT = 250)

4.3. ECOLOGICAL AGE

Evaluation:

Bog	% area x 15
Fen	% area x 9
Swamp	% area x 2
Marsh	% area x 1

(Maximum possible = 15)

(Maximum allowable for 4.0, SPECIAL FEATURES COMPONENT = 250)

PART III. WETLAND DATA RECORD

WETLAND DATA RECORD

(i). WETLAND NAME AND/OR NUMBER ____________________

(ii). ADMINISTRATIVE REGION ____________, AND DISTRICT ____________
OF ONTARIO MINISTRY OF NATURAL RESOURCES

(iii). CONSERVATION AUTHORITY JURISDICTION ____________________

If not within a designated Conservation Authority, check here ___

(iv). COUNTY OR REGIONAL MUNICIPALITY ____________________

(v). TOWNSHIP ____________________

(vi). LOTS AND CONCESSIONS ____________________

____

(vii). MAP AND AIR PHOTO REFERENCES

(a) Longitude and Latitude ____________________

(b) U.T.M. Grid Reference Zone: _______; Grid: ____________

(c) National Topographic Series Scale and Map Number(s) & Name _______

____

(d) Air Photos

(1) Date photo taken ____________________

(2) Scale of air photos ____________________

(3) Flight and plate numbers ____________________

____

(viii). WETLAND SIZE AND BOUNDARIES

(a) Single contiguous wetland area: ____________ hectares

OR

(b) "Wetland Complex" comprised of _______ individual wetlands as follows:.

Wetland Number (for reference purposes)	Size of each wetland in the complex	
Wetland No. 1	________	hectares
Wetland No. 2	________	"
Wetland No. 3	________	"
Wetland No. 4	________	"
Wetland No. 5	________	"
Wetland No. 6	________	"
Total size of wetland complex:	________	"

1.0. BIOLOGICAL COMPONENT

1.1. PRODUCTIVITY VALUES

1.1.1. Growing Degree-Days

Number of accumulated growing degree-days (check one)

______	<2800
______	2800 to 3200
______	3200 to 3600
______	>3600

1.1.2. Soils

	Estimated % of Area
- Clays, loams or silts (mineral)	______
- Organic	______
- Undesignated	______

1.1.3. Type of Wetland

(check one or more)

		Estimated % of Area
______	Bog	______
______	Fen	______
______	Swamp	______
______	Marsh (includes Open Water Marsh)	______

1.1.4. Site

(check one or more)

		Estimated % of Area
______	Isolated	______
______	Palustrine (permanent or intermittent outflow)	______
______	Riverine	______
______	Riverine (at rivermouth)	______
______	Lacustrine (at rivermouth)	______
______	Lacustrine (on enclosed bay)	______
______	Lacustrine (exposed to lake)	______

1.1.5. Nutrient Status of Surface Water

(a) Write conductivity bridge reading and calculate T.D.S. at 25°C as per tables in Appendix VIII.

Location Sampled (i.e. inflow, outflow, etc.)	Initial Specific Conductance (µmhos/cm)	Temperature (°C)		Total Dissolved Solids (T.D.S.) (mg/l)
______	______	______		______
______	______	______	=	______
______	______	______	=	______
______	______	______	=	______
______	______	______	=	______
		Average T.D.S.	=	______

(b) Check appropriate category (from (a))

Average T.D.S. mg/l	
<100	______
100-500	______
501-1500	______
>1500	______
NO READING	______

1.2. DIVERSITY VALUES

1.2.1. Number of Wetland Types

(check one)

______ One
______ Two
______ Three
______ Four

1.2.2. Vegetation Communities

(enter form and map code if available, or enter dominant species if known, and appropriate code/symbol)

a) One form

Code	
______	______
______	______
______	______
______	______

b) Two forms

Code

c) Three forms

Code

d) Four forms

Code

e) Five forms

Code

f) Six or more forms

Code

1.2.3. Diversity of Surrounding Habitat
(check all appropriate items)

_____ row crops
_____ pasture
_____ abandoned agricultural land
_____ deciduous forest
_____ coniferous forest
_____ urban or cottage development
_____ pits, quarries or mining waste disposal
_____ open lake or deep river
_____ fence rows with cover, or shelterbelts
_____ terraine undulating or hilly with ravines
_____ creek(s)

Enter Total = _______

1.2.4. Proximity to Other Wetlands
(check first appropriate category)

i) Hydrologically connected by surface water to other wetlands (different dominant type) or open water within 1.5 km. _____

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

iii) Hydrologically connected by surface water to other wetlands (different dominant type) or open water body from 1.5 to 4 km away. _____

iv) Hydrologically connected by surface water to other wetlands (same dominant type) from 0.5 to 1.5 km away. _____

v) Within 0.75 km of other wetlands (different dominant type) or open water body, but not hydrologically connected by surface water. _____

vi) Within 1 km of other wetlands, but not hydrologically connected by surface water. _____

vii) No wetland within 1.5 km. _____

1.2.5. Interspersion
(check one)

Type 1 _____
Type 2 _____
Type 3 _____
Type 4 _____

1.2.6. Open Water Types
(check one)
No open water ______
Type 1 ______
Type 2 ______
Type 3 ______
Type 4 ______
Type 5 ______
Type 6 ______
Type 7 ______
Type 8 ______

1.3. SIZE (Biological Component)
(refer to viii)
______________ hectares

2.0. SOCIAL COMPONENT

2.1. RESOURCE PRODUCTS WITH CASH VALUE

2.1.1. Timber (lumber and firewood)
(1) ______ 51 to 100% of wetland area has mature trees (>10 cm dbh, >25% cover)
(2) ______ 10 to 50% of wetland area has mature trees (as above)
(3) ______ Wetland has few, immature or no trees
Source of information: ______________________________

2.1.2. Wild Rice
(1) ______ Present
(2) ______ Absent
Source of Information: ______________________________

2.1.3. Commercial Fish (Bait Fish and/or Coarse Fish)
(1) ______ Fish harvested from the wetland (as per MNR)
(2) ______ Abundant during at least part of the year
(3) ______ Not abundant or only occasional
(4) ______ Habitat not suitable for fish
Source of Information: ______________________________

2.1.4. Bullfrogs
(1) ______ Present
(2) ______ Absent
Source of Information: ______________________________

2.1.5. Snapping Turtles
(1) ______ Present
(2) ______ Absent
Source of Information: ______________________

2.1.6. Furbearers
(check if present)

______ muskrat
______ raccoon
______ beaver
______ mink
______ other

Source of Information: ______________________

2.2. RECREATIONAL ACTIVITIES
(check appropriate spaces)

Intensity of Use	Hunting	Nature Appreciation or Study	Fishing	Canoeing/Boating
High				
Moderate				
Low				
None Known				
Not Possible				
Source of Information				

2.3. AESTHETICS

2.3.1. Landscape Distinctness
(1) ______ Clearly distinct
(2) ______ Indistinct

2.3.2. Absence of Human Disturbances

2.3.2.1. Level of Disturbance

(1) ______ Human disturbances absent or nearly so
(2) ______ One or several singular or localized disturbances
(3) ______ Moderate disturbance or localized water pollution
(4) ______ Impairment of natural quality intense in some areas or severe localized water pollution
(5) ______ Extremely intense disturbance or water pollution severe and widespread.

2.3.2.2. Types of Disturbances

______ roads
______ utility corridor
______ buildings
______ channelization
______ drainage
______ filling
______ water pollution
______ other: ____.

2.4. EDUCATION AND PUBLIC AWARENESS

2.4.1. Educational Uses

(1) ______ Frequent - an average of 2 or more visits per year by one or more school groups, local clubs for the purpose of studying the animals, plants, environment, etc.
(2) ______ Infrequent - use by organized groups (one visit or less per year or only casual visits)
(3) ______ No known visits

List groups utilizing the wetland

Name of Group(s)	Source of Information
________________________	________________________
________________________	________________________
________________________	________________________

2.4.2. Facilities and Programs
(check one)

(1) ______ Staffed interpretation center with shelters, trails, literature
(2) ______ No interpretation center or staff, but a system of self-guiding trails and observation points or brochures available
(3) ______ No facilities or programs

2.4.3. Research and Studies
(check one)

(1) ______ One or more wetland-related scientific research papers published in a scientific journal
(2) ______ One or more reports written outlining some aspect of the wetland's natural resources
(3) ______ No reports or papers

List scientific papers, reports, etc.

____
____
____

2.5. PROXIMITY TO URBAN AREAS
(check one)

(1) ______ In an urban or suburan area
(2) ______ <10 km from a population center greater than 10,000
(3) ______ 10 to 60 km from a population center greater than 10,000
(4) ______ Isolated or relatively remote

2.6. OWNERSHIP/ACCESSIBILITY

Estimate % of area and enter in the appropriate space(s)

ACCESSIBILITY	OWNERSHIP				
	Public, unrestricted activities	Public, restricted activities	Private, open to public for limited activities	Private Club, closed to public	Private or Private and posted
1) Easy at most times by road/waterway					
2) Easy only at certain times of the year					
3) Limited, moderate effort required					
4) Difficult*					

* Requires extended effort due to distance from roads, navigable waterways or isolated geographical position.

Source of information ______________________________

2.7. Size (Social Component)

_____ hectares (refer to viii)

3.0. HYDROLOGICAL COMPONENT

3.1. EFFECT OF ADJOINING LARGE WATER BODY

(1) _____ Wetland located on the Ottawa, St. Lawrence, Niagara, Detroit or St. Clair Rivers (Go to 3.3)
(2) _____ Wetland bordering on one of the Great Lakes (Go to 3.3)
(3) _____ Wetland not located as above (Go to 3.2)

If (1) or (2), omit Section 3.2, FLOW STABILIZATION. Continue with Section 3.3, WATER QUALITY IMPROVEMENT. If (3), proceed to Section 3.2.

3.2. FLOW STABILIZATION (All wetlands except those bordering on the Great Lakes or the 5 large rivers)

3.2.1. Detention Due to Surface Area

3.2.1.1. Size of Catchment Basin above Wetland Outflow

Catchment Basin Size __________ sq. km

3.2.1.2. Total Size of all Detention Areas (Lakes, Reservoirs and Wetlands) Draining into the Wetland (sq. km)

List Detention Areas	Size
______________________________	______
______________________________	______
______________________________	______
______________________________	______
______________________________	______
______________________________	______
______________________________	______
Total	______ sq. km

3.2.1.3. Size of Adjoining Lake (Lacustrine wetlands only)

_____ hectares

3.2.1.4. Size of Adjoining River (Riverine wetlands only) (not assessed)

3.2.1.5. Location and Size of Detention Areas (Lakes, Reservoirs and Wetlands) within 30 km above and below the wetland

(NOTE: 1 sq. km = 100 ha)

(a) Detention areas above the wetland (within 30 km)

Name and/or Number of Detention Area	Distance upstream from wetland (in km)	Size (hectares)	For Scoring Use

(b) Detention areas below the wetland (within 30 km)

Name and/or Number of Detention Area	Distance downstream from wetland (in km)	Size (hectares)	For Scoring Use

3.2.1.6. Land Use along River or Stream Shoreline for 20 km Below the Wetland
(Palustrine and all Riverine wetlands except those located along the 5 large rivers).

(check one)

(1) Wetland outflow exits into a deep ravine ______
(2) A village, town or urban area is located along outflow within 20 km ______
(3) Not as above, and actively farmed agricultural land borders onto outflow, and

length of agricultural border =	<1 km	______
(sum of shoreline	1-3	______
on both sides of	4-8	______
river within 20 km)	>8	______

(4) Not as above, (eg. lands bordering outflow within 20 km are forested, or abandoned by agriculture, or outflow enters another wetland or lake, etc.) ______

3.2.1.7. Size (Hydrological Component)
(see viii)
__________ ha

3.2.2. Flow Augmentation (Palustrine wetlands only)

Size of Catchment basin __________ sq. km (See 3.2.1.1)
Wetland Area as a % of Catchment Basin Size _____%
(Note: convert wetland area to sq. km before calculating %)

3.3. WATER QUALITY IMPROVEMENT (All wetlands)

3.3.1. Short Term Removal of Nutrients from Surface Water

3.3.1.1. Site Type (see 1.1.4 and check dominant site)

______ Isolated
______ Palustrine (with permanent or intermittent outflow)
______ Riverine
______ Riverine (at rivermouth)
______ Lacustrine (at rivermouth)
______ Lacustrine (on enclosed bay)
______ Lacustrine (exposed to lake)

3.3.1.2. Actual Wetland Area Dominated by Robust Emergents and Submergents
(check one)

_______ <5
_______ 5 - 50
_______ 51 - 100
_______ 101 - 250
_______ 251 - 500
_______ 501 - 1000
_______ >1000 hectares

3.3.1.3. Land Use in Catchment Basin
(check one)

(1) _______ Mainly agriculture and/or urban
(2) _______ Roughly 40-60% agriculture; remainder forested or abandoned agriculture
(3) _______ Mainly forested and/or less than 40% agriculture

3.3.2. Long Term Nutrient Trap
(check one)

(1) _______ Wetland located on an active delta
(2) _______ Wetland rivermouth but without obvious delta
(3) _______ Wetland with organic soils occupying 50% or more of the area
(4) _______ Wetland with organic soils occupying less than 50% of the area (i.e. mainly mineral or undesignated soils)

3.4. EROSION CONTROL

3.4.1. Erosion Buffer (Lacustrine and Riverine wetlands only)

NOTE: Assess for the dominant site type (see 3.3.1.1)

3.4.1.1. Riverine Wetlands (shoreland and flood plain)
(check principal vegetation form)

(1) _______ Trees or Shrubs
(2) _______ Emergents
(3) _______ Non-vegetated or nearly so

3.4.1.2. Lacustrine Wetlands (with or without barrier beach)
(check principal vegetation form)

(1) _______ Trees or Shrubs
(2) _______ Emergents
(3) _______ Submergents and Floating
(4) _______ Non-vegetated or nearly so

3.4.1.3. Fetch (Lacustrine wetlands or Riverine wetlands on any of the 5 large rivers)

Maximum distance

(1) _______ barrier beach present
(2) _______ <2 km
(3) _______ 2 to 8 km
(4) _______ >8 km

3.4.2 Sheet Erosion (All except Lacustrine wetlands)
(check the appropriate space)

Wetland Size (ha)	R FACTOR VALUE			
	<50	50-75	75-100	>100
<2				
2-5				
6-10				
11-15				
16-20				
>20				

4.0. SPECIAL FEATURES COMPONENT

4.1. RARITY AND/OR SCARCITY

4.1.1. Individual Wetlands

Name of Physiographic Unit: ____________________

Unit Number: ________

4.1.2. Wetland Type Representation (minimum size 0.5 ha)

(check one or more)

________ Marsh
________ Swamp
________ Fen
________ Bog

4.1.3. Individual Species

4.1.3.1. Breeding Habitat for an Endangered Animal or Plant Species

	Name of Species	Source of Information
(1)		
(2)		

4.1.3.2. Traditional Migration or Feeding Habitat for an Endangered Animal Species

	Name of Species	Source of Information
(1)		
(2)		

4.1.3.3. Breeding or Feeding Habitat for a Provincially Significant Animal Species

	Name of Species	Source of Information
(1)		
(2)		

4.1.3.4. Provincially Significant Plant Species

	Name of Species	Source of Information
(1)		
(2)		

4.1.3.5. Regionally Significant Species

	Name of Species	Source of Information
(1)	______________	______________
(2)	______________	______________
(3)	______________	______________
(4)	______________	______________

4.2. SIGNIFICANT FEATURES AND/OR FISH AND WILDLIFE HABITAT

4.2.1. Nesting of Colonial Waterbirds

(check one)

(1) ________ Currently nesting; species name(s) ________
(2) ________ Known to have nested within past 5 years; species name(s) ________
(3) ________ Active feeding area
(4) ________ None known

Source of Information: ________________

4.2.2. Winter Cover for Wildlife

(check only highest level of significance)

(1) ________ Provincial signficance for Deer ______, Moose ______
(2) ________ Regional significance for Deer ______, Moose ______
(3) ________ Local significance for Deer ______, Moose ______
(4) ________ Good winter cover for other species (list): ________
____
____
(5) ________ Poor winter cover

Source of Information: ________________

4.2.3. Waterfowl Staging

(check only highest level of significance)

(1) ________ National significance
(2) ________ Provincial significance
(3) ________ Regional signficance
(4) ________ Local or no significance

Source of Information: ________________

4.2.4. Waterfowl Production

(check only highest level of significance)

(1) ________ Provincial significance
(2) ________ Regional significance
(3) ________ Local significance
(4) ________ Little or no significance

Source of Information: ________________

4.2.5. Migratory Passerine and/or Shorebird Stopover Area
(check one)
(1) _________ High significance
(2) _________ No significance
Source of Information: ______________________________

4.2.6. Significance for Fish Spawning and Rearing
(check one)
(1) _________ Regional significance
(2) _________ Present
(3) _________ Unknown
(4) _________ Not possible
Species and Source of Information: ________________
____

4.2.7. Unusual Geological or other Surficial Features
(check one)
(1) _________ Present
Feature and Source of Information: ________________
____
(2) __________ Poorly expressed or absent

4.3. ECOLOGICAL AGE

Type of Wetland	Enter % of Area
________ Bog	______
________ Fen	______
________ Swamp	______
________ Marsh	______

INVESTIGATORS

____
____
____

AFFILIATION

____

DATE

____

ESTIMATED TIME DEVOTED TO COMPLETING THE FIELD SURVEY IN "PERSON HOURS"

____________________.

WEATHER CONDITIONS
(i) at time of field work: ____
(ii) summer conditions in general: ___________________________________

PART IV. WETLAND EVALUATION RECORD

WETLAND EVALUATION RECORD

WETLAND NAME AND/OR NUMBER ______________________________

1.0 BIOLOGICAL COMPONENT

1.1. PRODUCTIVITY VALUES

1.1.1.	Growing Degree-Days	____
1.1.2.	Soils	____
1.1.3.	Type of Wetland	____
1.1.4.	Site	____
1.1.5.	Nutrient Status of Surface Water	____

TOTAL for Productivity Values ____

1.2. DIVERSITY VALUES

1.2.1.	Number of Wetland Types	____
1.2.2.	Vegetation Communities (not to exceed 30)	____
1.2.3.	Diversity of Surrounding Habitat	____
1.2.4.	Proximity to Other Wetlands	____
1.2.5.	Interspersion	____
1.2.6.	Open Water Types	____

TOTAL for Diversity Values ____

1.3. SIZE (Biological Component) ____

TOTAL FOR BIOLOGICAL COMPONENT (not to exceed 250) ____

2.0 SOCIAL COMPONENT

2.1. RESOURCE PRODUCTS WITH CASH VALUE

2.1.1. Timber (lumber and firewood) ______
2.1.2. Wild Rice ______
2.1.3. Commercial Fish (Bait Fish and/or Coarse Fish) ______
2.1.4. Bullfrogs ______
2.1.5. Snapping Turtles ______
2.1.6. Furbearers ______

TOTAL for Resource Products with Cash Value (not to exceed 60) ______

2.2. RECREATIONAL ACTIVITIES (not to exceed 70) ______

2.3. AESTHETICS

2.3.1. Landscape Distinctness ______
2.3.2. Absence of Human Disturbances ______

TOTAL for 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 URBAN AREAS ______

2.6. OWNERSHIP/ACCESSIBILITY ______

2.7. SIZE (Social Component) ______

TOTAL FOR SOCIAL COMPONENT (not to exceed 250) ______

3.0. HYDROLOGICAL COMPONENT

3.1. EFFECT OF ADJOINING LARGE WATER BODY

3.2. FLOW STABILIZATION

3.2.1. Detention Due to Surface Area
3.2.1.1. and
3.2.1.2. FIRST step (from table) ______
3.2.1.3. SECOND step minus ______ = ______
3.2.1.5. THIRD step minus ______ = ______
3.2.1.6. FOURTH step minus ______ = ______ ←(minimum allowable = 0)
3.2.1.7. FIFTH step plus ______ = ______

TOTAL for Detention Due to Surface Area ______

3.2.2. Flow Augmentation (from table) ______

TOTAL for Flow Stabilization ______

3.3. WATER QUALITY IMPROVEMENT

3.3.1. Short Term Removal of Nutrients from Surface Water
3.3.1.1. Site Type ______
3.3.1.2. Actual Wetland Area Dominated by Robust Emergents and Submergents ______
3.3.1.3. Land Use in Catchment Basin ______

TOTAL for Short Term Removal of Nutrients from Surface Water ______

3.3.2. Long Term Nutrient Trap ______

TOTAL for Water Quality Improvement ______

3.4. EROSION CONTROL

3.4.1. Erosion Buffer
3.4.1.1. Riverine Wetlands ______
3.4.1.2. Lacustrine Wetlands ______
3.4.1.3. Fetch ______

TOTAL for Erosion Buffer ______

3.4.2. Sheet Erosion ______

TOTAL for Erosion Control ______

TOTAL FOR HYDROLOGICAL COMPONENT (not to exceed 250) ______

4.0 SPECIAL FEATURES COMPONENT

4.1. RARITY AND/OR SCARCITY

4.1.1. Individual Wetlands ______
4.1.2. Wetland Type Representation ______
4.1.3. Individual Species
4.1.3.1. Breeding Habitat for an Endangered Animal or Plant Species ______
4.1.3.2. Traditional Migration or Feeding Habitat for an Endangered Animal Species ______
4.1.3.3. Breeding or Feeding Habitat for a Provincially Significant Animal Species ______
4.1.3.4. Provincially Significant Plant Species ______
4.1.3.5. Regionally Significant Species ______

TOTAL for Individual Species (not to exceed 250) ______

TOTAL FOR RARITY AND/OR SCARCITY (not to exceed 250) ______

4.2. SIGNIFICANT FEATURES AND/OR FISH AND WILDLIFE HABITAT

4.2.1. Nesting of Colonial Waterbirds ______
4.2.2. Winter Cover for Wildlife ______
4.2.3. Waterfowl Staging ______
4.2.4. Waterfowl Production ______
4.2.5. Migratory Passerine and/or Shorebird Stopover Area ______
4.2.6. Significance for Fish Spawning and Rearing ______
4.2.7. Unusual Geological or other Surficial Features ______

TOTAL FOR SIGNIFICANT FEATURES AND/OR FISH AND WILDLIFE HABITAT (not to exceed 250) ______

4.3. ECOLOGICAL AGE ______

TOTAL FOR SPECIAL FEATURES COMPONENT (not to exceed 250) ______

SUMMARY OF EVALUATION RESULTS

FOR THE ______________________________ WETLAND
(name or number)

TOTAL FOR 1.0, BIOLOGICAL COMPONENT ____

TOTAL FOR 2.0, SOCIAL COMPONENT ____

TOTAL FOR 3.0, HYDROLOGICAL COMPONENT ____

TOTAL FOR 4.0, SPECIAL FEATURES COMPONENT ____

INVESTIGATORS

____
____
____

AFFILIATION

____

DATE

____

REFERENCES

AND

APPENDICES

REFERENCES

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APPENDIX I.

FEDERATION OF ONTARIO NATURALISTS

FEDERATED NATURE CLUBS

June 1983

(Southern Ontario)

BRANTFORD NATURE CLUB
Mrs. Anna Burke, President — BRANTFORD
9 Lombard Street
Brantford, Ontario
N3R 2C1

BRODIE NATURE CLUB
Mr. J. Riley, FON Representative — TORONTO based
101 Glen Manor Drive #20
Toronto, Ontario
M4E 3V3
416-694-4217 (home)
416-965-1183 (office)

CANADIAN AMPHIBIAN & REPTILE
CONSERVATION SOCIETY — TORONTO
9 Mississauga Road North
Mississauga, Ontario
L5H 2H5

DURHAM REGION FIELD NATURALISTS
P.O. Box 354 — OSHAWA
Oshawa, Ontario
L1H 7L3

GEORGIAN BAY BIRD AND WILDLIFE ASSOC.
Mr. J. P. Charlebois, President — BURLINGTON
1457 Ontario Street
Burlington, Ontario
L7R 1G6
416-634-5542 (office)
Toronto number 416-825-0502

GUELPH NATURALISTS CLUB
P.O. Box 1401 — GUELPH
Guelph, Ontario
N1H 6N8

HALTON FIELD NATURALISTS
P.O. Box 115 — GEORGETOWN
Georgetown, Ont.
L7G 4T1

HAMILTON NATURALISTS CLUB
Mr. Norman Ralston, President — HAMILTON
Postal Stn. E, Box 5182
Hamilton
L8S 4L3
416-381-1397 (home)

INGERSOLL NATURE CLUB
Dr. J. Lawson, President — INGERSOLL
60 King Street West
Ingersoll, Ontario
N5C 2J5
519-485-1100 (home)

KENT NATURE CLUB
114 Park Avencue West — CHATHAM
Chatham, Ontario
N7M 1V9

KINGSTON FIELD NATURALISTS
P.O. Box 831 — KINGSTON
Kingston, Ontario
K7L 4X6

KITCHENER-WATERLOO FIELD NATURALISTS
c/o 317 Highland Road East — KITCHENER-WATERLOO
Kitchener, Ontario
N2M 3W6

LAMBTON WIDLIFE INC.
Ms. Nan McNair, FON Representative — SARNIA
P.O. Box 681
Sarnia, Ontario
N7T 7J7

LONG POINT BIRD OBSERVATORY
Dr. A. Langford — PORT ROWAN
Executive Director
Box 160
Port Rowan, Ontario
NOE 1MO
519-586-2909 (office)

MARGARET NICE ORNITHOLOGICAL CLUB
Mrs. Ida Hanson, FON Representative — TORONTO
83 Joicey Boulevard
Toronto, Ontario
M5M 2T4
416-488-0553 (home)

MCILWRAITH FIELD NATURALISTS
P.O. Box 4185 — LONDON
London, Ontario
N5W 5R5

NIAGARA FALLS NATURE CLUB Mr. Charlie Pryer, President 17 Parklane Crescent St. Catharines, Ontario L2T 3T9 416-685-9147 (home) 416-685-4664 (office)	NIAGARA FALLS
NORFOLK FIELD NATURALISTS Mr. Donald Walker, FON Representative 14 Simcoe Boulevard Simcoe, Ontario N3Y 3L5 519-426-0326 (home) 519-586-3522 (office)	SIMCOE
ONTARIO BIRD BANDING ASSOC. Mr. Bob Hubert, Pres. 10 Paulsen Crt. St. Thomas, Ont. N5R 1M9	PORT ROWAN based
ONTARIO FIELD ORNITHOLOGISTS P.O. Box 1204 Stn. B Burlington, Ont. L7P 3S9	BURLINGTON
OTTAWA FIELD NATURALISTS Box 3264, Station C Ottawa, Ontario K1Y 4J5	OTTAWA
PENINSULA FIELD NATURALISTS CLUB Box 544 St. Catharines, Ont. L2R 6W8	NIAGARA PENINSULA
PETERBOROUGH FIELD NATURALISTS Box 1532 Peterborough, Ontario K9J 7H7	PETERBOROUGH
PICKERING NATURALISTS P.O. Box 304 Pickering, Ontario L1V 2R6	PICKERING-CLAREMONT
PRESQU'ILE-BRIGHTON NATURALISTS Mr. Walter Blackburn, President 190 Prince Edward Street Box 1556 Brighton, Ontario K0K 1H0	BRIGHTON

QUINTE FIELD NATURALISTS — BELLEVILLE
Mr. Terry Sprague, FON Representative
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RESOURCES MANAGEMENT CLUB — GUELPH
Land Resources Science Department
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RICHMOND HILL NATURALISTS — RICHMOND HILL
P.O. Box 285
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L4C 4Y2

RIDEAU TRAIL ASSOCIATION — KINGSTON
P.O. Box 15
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ST. THOMAS FIELD NATURALISTS — ST. THOMAS
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SIERRA CLUB OF ONTARIO — TORONTO based
47 Colborne Street
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Toronto, Ontario
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SOUTH PEEL NATURALISTS CLUB — MISSISSAUGA-OAKVILLE
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STRATFORD FIELD NATURALISTS — STRATFORD
Mrs. J. Turnbull, President
82 Mornington Street
Stratford, Ontario
N5A 5E8

SUN PARLOR NATURE CLUB — LEAMINGTON
Mr. Donald C. Ross
18 Noble St.
Leamington, Ont.
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TORONTO ENTOMOLOGICAL ASSOC. c/o Al Hanks 34 Seaton Dr. Aurora, Ont. L4G 2K1	TORONTO
TORONTO FIELD NATURALISTS Mrs. Mary Smith, President 49 Thorncrest Road Islington, Ontario M9A 1S6	TORONTO
TORONTO ORNITHOLGOICAL CLUB Mr. Eric Nasmith, President 28 Donwoods Drive Toronto, Ontario M4N 2G1	TORONTO
UPPER OTTAWA VALLEY NATURE CLUB Box 591 Deep River, Ontario K0J 1P0	OTTAWA VALLEY
WATERFOWL RESCUE Dr. Bob Edmondson, President 310 Main Street Milton, Ontario L9T 2L7	OAKVILLE based
WEST ELGIN NATURE CLUB Mr. Brad Reive, President R.R. 2 West Lorne, Ontario N0L 2P0	WEST LORNE
WEST HUMBER NATURALISTS CLUB Mr. Dean Newton, President Box 287 Kleinburg, P.O. Ontario L0J 1C0	KLEINBURG area
WILDERNESS ADVENTURERS OF ONTARIO c/o Ms. Catherine Munro 40 Homewood Avenue Apt. 1102 Toronto, Ontario M4Y 2K2	TORONTO

WILDERNESS CANOE ASSOCIATION
P.O., Box 496
Postal Station K
Toronto, Ontario
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TORONTO based

WILLOW BEACH FIELD NATURALISTS
c/o Mr. Brian Olson
439 Division Street
Cobourg, Ontario
K9A 3R8

COBOURG-PORT HOPE

WOODSTOCK FIELD NATURALISTS
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N4S 8A3

WOODSTOCK

APPENDIX II.

LIST OF MAPS

(1) Canada Land Inventory (CLI) maps entitled "Soil Capability for Agriculture; scale 1:50,000 available from Environment Canada or Map and Sales Office, EMR, 615 Booth St., Ottawa K1A 0E9

(2) Organic Soil Maps, scale 1:50,000, available from Institute of Pedology, Blackwood Hall, University of Guelph, Guelph N1G 2W1

(3) County Soil Maps, available from Ontario Ministry of Agriculture and Food or the Ontario Ministry of Natural Resources.

(4) Wetland Mapping Series, Second Approximation. Lands Directorate, Environment Canada (Ontario Region), 1983. (128 maps). Available from Environment Canada; and MNR, Queens Park (Wildlife Branch), Toronto.

(5) Administrative Regions and Districts, Ministry of Natural Resources, Ontario, June 1981.

(6) National Topographic Series (N.T.S.) Maps, available from the Dept. of Energy, Mines and Resources. Scales 1:25,000, 1:50,000, 1:250,000.

(7) Forest Resources Inventory maps, available from MNR, Public Service Centre, RM 1640, Whitney Block, Toronto M79 1W3

(8) Watershed maps (Conservation Authority)

(9) Hydrographic Charts, available from Canada Map Office, 615 Booth St., Ottawa.

(10) Air Photos, available from MNR, Public Service Centre, Room 6404, Whitney Block, Queens Park, Toronto. Also available from District Offices of MNR or Conservation Authorities.

APPENDIX III.

LIST OF FIELD GUIDES AND MANUALS TO BE USED BY WETLAND EVALUATION CREW

Insects

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APPENDIX IV.

REPRESENTATIVE PLANT SPECIES BY VEGETATION FORMS AND WETLAND TYPES

(vegetation forms adapted from Golet (1976), wetland types following Jeglum et al. 1974).

TREES - woody vegetation greater than 6 metres in height.

(1) Deciduous Trees - living, broad-leaved trees.

- SWAMP -

Silver (soft) Maple	*Acer saccharinum* L.
Red maple	*Acer rubrum* L.
Red Ash	*Fraxinus pennsylvanica* Marsh.
Black Ash	*Fraxinus nigra* Marsh.
White Elm	*Ulmus americana* L.
Poplar	*Populus* spp.
Black Willow	*Salix nigra* Marsh.
Hickory	*Carya* spp.
Bur Oak	*Quercus macrocarpa* Michx.
Pin Oak	*Quercus palustris* Muenchh.
Black Gum	*Nyssa sylvatica* Marsh.

(2) Coniferous Trees - living, needle- or scale-leaved trees.

-SWAMP, BOG, FEN-

Eastern White Cedar	*Thuja occidentalis* L.
Tamarack	*Larix laricina* (Du Roi) K. Koch.
Black Spruce	*Picea mariana* (Mill.) B.S.P.

(3) Dead Trees - standing dead trees (and tree stumps 2 m or more in height

Tree Species Usually found in Upland or Wetland Margins

Eastern White Pine	*Pinus strobus* L.
Sugar Maple	*Acer saccharum* Marsh.
White Birch	*Betula papyrifera* Marsh.
Hop-Hornbeam	*Ostrya virginiana* (Mill.) K. Koch.
American Beech	*Fagus grandiflora* Ehrh.
Bitternut Hickory	*Carya cordiformis* (Wang.) K. Koch.
White Ash	*Fraxinus americana* L.

SHRUBS - woody vegetation less than 6 metres in height. Woody plants taller than 6 m at maturity (and commonly called trees) are considered shrubs when less than 6 m in height. Includes vines.

(4) Tall Shrubs - less than 6 m in height but greater than 1 m, usually with a distinct crown and trunk.

- THICKET SWAMP -

Speckled Alder	* Alnus rugosa (Du Roi) Spreng
Slender Willow	* Salix petiolaris Sm.
Willow	* Salix spp.
Red Osier Dogwood	* Cornus stolonifera Michx.
Dogwood	* Cornus racemosa Lam.
Poison (Swamp) Sumach	* Rhus vernix L.
Buttonbush	* Cephalanthus occidentalis L.
Winterberry	* Ilex verticillata (L.) Gray
Mountain Holly	Nemopanthus mucronatus (L.) Trel.

(5) Low Shrubs - less than 1 m in height, with dense foliage and several stems.

- THICKET SWAMP -

Swamp Rose	* Rosa palustris Marsh.
Water Willow	* Decodon verticillatus (L.) Ell.
Spiraea	* Spiraea spp.
Sweet Gale	* Myrica gale L.

(* denotes species also having affinities for shrub-rich Marsh)

- FEN -

Leatherleaf	Chamaedaphne calyculata (L.) Moench.
Willow	Salix pedicellaris Pursh.
Sweet Gale	Myrica gale L.
Chokeberry	Aronia prunifolia (Marsh.) Rehder
Labrador Tea (occasional)	Ledum groenlandicum Oeder
Bog Rosemary	Andromeda glaucophylla Linke
Alder-leaved Buckthorn	Rhamnus alnifolius L'Hér
Shrubby Cinquefoil	Potentilla fruticosa L.

- BOG -

Leatherleaf	Chamaedaphne calyculata (L.) Moench.
Sheep Laurel	Kalmia angustifolia L.
Chokeberry	Aronia prunifolia (Marsh.) Rehder
Swamp Blueberry	Vaccinium corymbosum L.
Labrador Tea	Ledum groenlandicum Oeder
Bog Rosemary (occasional)	Andromeda glaucophylla Link.
Bilberry	Vaccinium myrtilloides Man.
Black Huckleberry	Gaylussacia baccata (Wang.) K. Koch.

- UPLAND SPECIES -

Black Raspberry	Rubus occidentalis L.
Poison Ivy	Rhus radicans L.
Snowberry	Symphoricarpos albus (L.) Blake

(6) Dead Shrubs - standing dead shrubs (and tree stumps less than 1 m in height).

GROUND COVER -

(7) Herbs - erect, rooted, non-woody (herbaceous) plants growing on moist, but exposed soil. Includes ferns.

- BOG -

Pitcher Plant	*Sarracenia purpurea* L.
Sundew	*Drosera* spp.
Buckbean	*Menyanthes trifoliata* L.

- SWAMP -

Jewelweed	*Impatiens capensis* Meerb
Water-horehound	*Lycopus virginicus* L.
Royal Fern	*Osmunda regalis* L. var. *spectabilis* (Willd.) A. Gray
Ragged Fringed Orchis	*Plantathera lacera*

(8) Moss - plant a moss with weak stems crowded compactly together forming a mat.

- BOG -

Sphagnum	*Sphagnum* spp.

- FEN -

"Brown mosses"	*Campylium stellatum*
	Drepanocladus revolvens
	Tomenthypnum nitens
	Scorpidium scorpioides

EMERGENTS - erect, rooted, herbaceous plants which may be temporarily or permanently flooded at the base but are nearly always exposed at the upper portion.

(9) Narrow-leaved Emergents - grass- or sedge-like emergents, less than 1.8 m in height, growing on moist or seasonally flooded soils.

- MARSH -

Wild Rice	*Zizania aquatica*
Burreed	*Sparganium* spp.
Horsetail	*Equisetum* spp.
Cordgrass	*Spartina pectinata*
Reed Canary Grass	*Phalaris arundinacea*
Blue Joint	*Calamagrostis canadensis*
Cut Grass	*Leersia oryzoides*
Sedges	*Carex* spp.
Rushes	*Juncus* spp.

(10) Broad-leaved Emergents - broad-leaved emergents less than 1 m in height.

- MARSH -

Pickerel Weed	*Pontederia cordata*
Water Arum	*Calla palustris*
Arrow Arum	*Peltandra virginica*
Beggars-ticks	*Bidens* spp.
Arrowheads	*Sagittaria* spp.
Water Plantains	*Alisma* spp.
Smartweeds	*Polygonum* spp.

(11) Robust Emergents - stout, erect emergents from 1.5 - 3 m in height.

- MARSH -

Cattails	*Typha* spp.
Bulrushes	*Scirpus* spp.
Common Reed Grass	*Phragmites communis*

SURFACE VEGETATION - herbaceous plants (vascular hydrophytes) with leaves or entire plant floating on the water surface.

(12) Free-floating plants - non-rooted, free-moving, vascular hydrophytes floating on the water surface.

- MARSH, SWAMP -

Big Duckweed	*Spirodela polyrhiza*
Lesser Duckweed	*Lemna minor*
Star Duckweed	*Lemna trisulca*
Watermeal	*Wolffia spp.*

(13) Floating plants - rooted, vascular hydrophytes with leaves floating horizontally on the water surface.

- MARSH -

White Water lily	*Nymphaea odorata*
Yellow Water lily	*Nuphar variegatum*
Pondweeds	*Potamogeton spp.*
Water Smartweed	*Polygonum amphibium*

SUBMERGENTS - hydrophytes that are entirely submerged beneath the water surface, except for flowering parts in some species.

(14) Submerged Plants -

- MARSH -

Pondweed	*Potamogeton* spp.
Coontail	*Ceratophyllum demersum*
Water Milfoils	*Myriophyllum* spp.
Wild Celery	*Vallisneria americana*
Waterweeds	*Elodea* spp.
Bladderworts	*Utricularia* spp.
Muskgrasses	*Chara* spp.

APPENDIX V.

GUIDELINES FOR THE PREPARATION OF MAPS

The decision as to the number of wetland maps that are to be prepared will be made by the field crew and will be based upon the complexity of wetland features. In any event, two maps are essential.

(a) The wetland vegetation map, depicting the outer boundary of the wetland as per field observations and boundaries delimiting dominant vegetation forms for the assessment of interspersion.

(b) The drainage basin map showing location and size of wetlands and waterbodies in the drainage basin above and below the wetland. Only one map will be required for all the wetlands in the drainage basin. This map may help provide a perspective for determining site location, catchment areas, etc.

The recommended approach in preparing the vegetation map is:

First, prior to field work, scrutinize the air photos of the wetland to ascertain access points and locations of areas which appear to be difficult or impossible to interpret from the photos.

Second, when in the field, examine all readily accessible portions of the wetland, noting down the combinations of vegetation forms, and marking visible boundaries between areas of different dominant vegetation form directly on the air photo with a wax pencil (or onto an acetate sheet taped over the photo). The "edge" between these areas of different dominant (upper layer) vegetation forms is evaluated to determine interspersion. Boundaries between different vegetation communities (combinations of vegetation forms) are not evaluated, and need not be mapped. If mapped, differentiate these "community boundaries" from the "interspersion (structural edge) boundaries" to avoid confusion in assessing interspersion. An example may illustrate the difference between a "community boundary" and an "interspersion boundary". A "community boundary" might be recognized between a community dominated by deciduous trees, herbs and moss and one dominated by deciduous trees, low shrubs and herbs, (i.e. a change in one or more of the "subordinate" vegetation forms). An "interspersion boundary" would be recognized where an area dominated by deciduous trees contacts an area dominated by low shrubs (i.e. a change in dominant (upper layer) vegetation form). An interspersion boundary can occur between any 2 of the 14 vegetation forms shown in Figures 7a, b of Part I of this manual.

Third, all areas of the wetland that still have doubtful interpretations must be visited to ascertain vegetation forms, as well as to determine wetland boundaries.

Lastly, when back in the office, extrapolations must be made on the air photos or on the draft wetland map. All boundaries should now be satisfactorily interpreted. As vegetation communities often grade into each other, one will of necessity have to draw boundaries through areas of gradual ecological change.

Diversity of surrounding habitat need not be mapped -- unless important information not recorded in the wetland Data Record would be added.

For map drawing, use the conventional map symbols and vegetation form symbols noted here to ensure maximum consistency between maps of different wetlands. A legend summarizing all symbols used should be included as part of your map, as shown in the sample legend accompanying Figure A.

Table A summarizes the dominant vegetation forms usually associated with the 4 wetland types, showing abbreviations for notation. In most cases, only a single vegetation form is mapped, for example tsS (tall shrub (thicket) Swamp). For bogs and fens, a "subtype" (subformation) modifier is added to reflect presence/absence of low density trees in the wetland, for example 05ne30B indicates open bog with 5% tree cover dominated by narrow-leaved emergent cover of 30%. (The dominant strata for assessing interspersion is the narrow-leaved emergent layer). Percent cover data is included if available; otherwise leave blank. For the Open Water Marsh "subtype", the W symbol is substituted for the M (Marsh) symbol; thus we write suW for Open Water Marsh dominated by submergents.

If problems arise in designating boundaries between wetland types or dominant vegetation forms, there are Keys to Wetland Classification provided in Appendix VII which may be helpful.

The information collected in field notes regarding composition of vegetation communities, i.e. combinations of forms present, should be listed in the legend of the wetland map along with a number code to indicate location of that community on the map. Remember the general "rule of thumb" that about 25% of an area (community) must have a vegetation form in order for it to count as an additional form. Dominant species of each of the vegetation forms in a community should be recorded, where know, including percent cover if known. If recorded, this information provides useful baseline information for future reference. <u>However</u>, this species/percent cover information is <u>NOT</u> required in order to evaluate a wetland, and additional time should <u>NOT</u> be spent trying to obtain such details.

Figure A is a sample wetland vegetation map prepared for the Lynde Shores Marsh, showing features such as outer wetland boundary, wetland types, interspersion of dominant vegetation forms, open water pattern, area dominated by robust emergents and submergents, map scale, and a legend including a list of vegetation communities and species. The degree of interspersion varies from high in the north portion of the wetland to low in the south portion, giving an average interspersion of Type 3, and it is this latter "average type" that should be recorded in the data record.

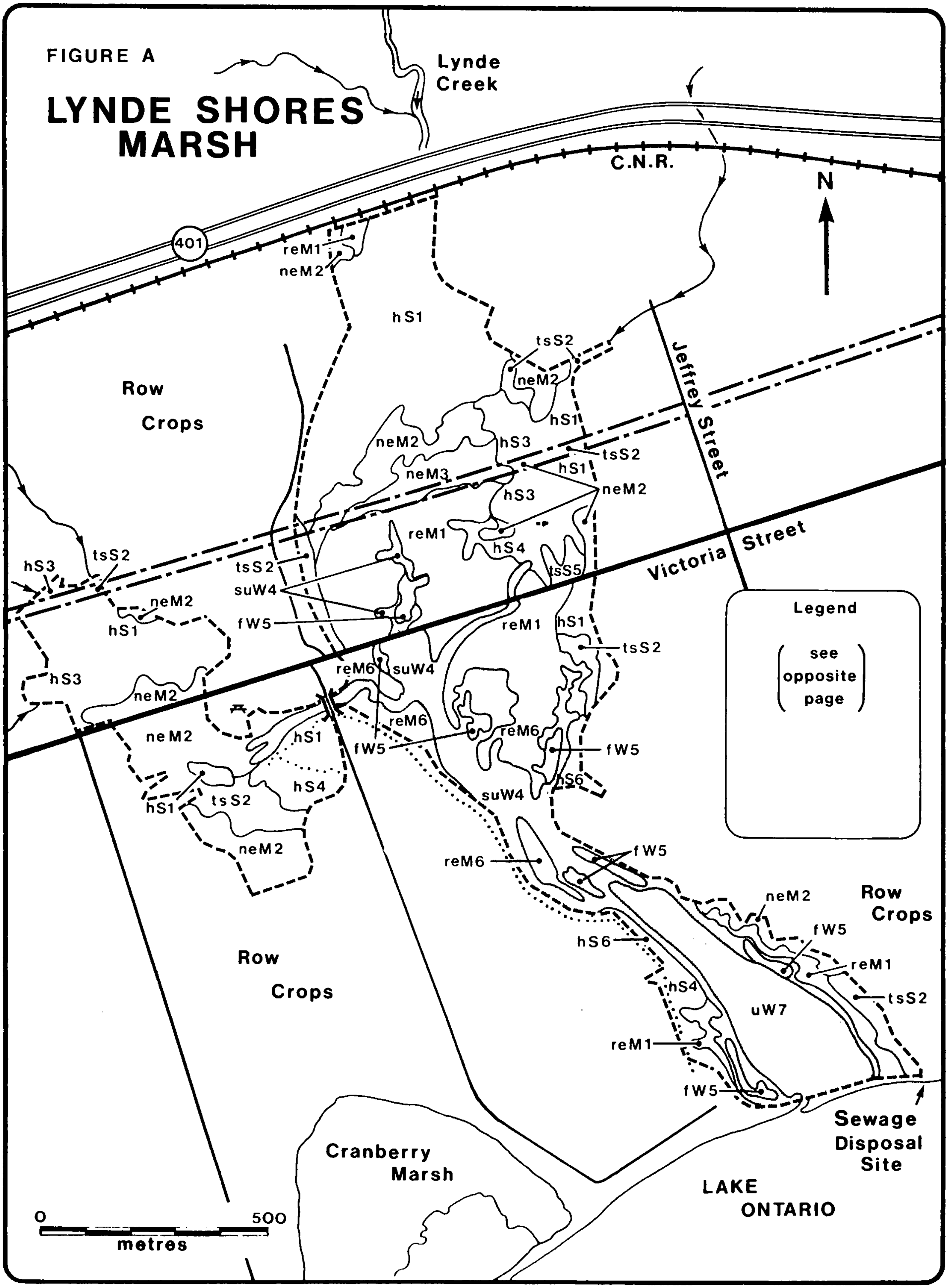
FIGURE A
LYNDE SHORES MARSH
Lynde Creek
C.N.R.
401
N
Row Crops
Jeffrey Street
Victoria Street
Legend
see opposite page
Row Crops
Row Crops
Cranberry Marsh
LAKE ONTARIO
Sewage Disposal Site
0
500
metres
reM1
neM2
hS1
tsS2
neM2
hS1
neM2
hS3
tsS2
neM3
hS1
neM2
hS3
reM1
hS4
tsS5
tsS2
suW4
fW5
reM1
hS1
tsS2
hS3
tsS2
neM2
hS1
hS3
neM2
reM6
suW4
reM6
reM6
fW5
fW5
neM2
hS1
hS4
hS1
tsS2
neM2
hS6
suW4
reM6
fW5
neM2
fW5
reM1
tsS2
hS6
hS4
uW7
reM1
fW5

Legend

- Highway
- County Road
- Minor Road
- Trail
- Railway
- Utility Corridor
- Wetland Boundary
- Upland/Pit
- Buildings
- Campsite; Picnic Site
- Bridge
- Dyke
- Beaver Dam
- River, Creek
- Intermittent Stream
- Nesting Island
- Mudflats
- Open Water
- Conductivity Reading Site

VEGETATION FORMS

h	Deciduous Trees
c	Coniferous Trees
dh,dc	Dead Trees
ts	Tall Shrubs
ls	Low Shrubs
ds	Dead Shrubs
sr	Shrub-rich
gc	Herbs (ground cover)
m	Moss
ne	Narrow-leaved Emergents
be	Broad-leaved Emergents
re	Robust Emergents
ff	Free-Floating Plants
f	Floating Plants (rooted)
su	Submerged Plants
u	Unvegetated

WETLAND TYPES

M	Marsh
W	Open Water Marsh
S	Swamp
F	Fen
B	Bog

Subsequent number corresponds to List of Vegetation Communities (below).

LIST OF VEGETATION COMMUNITIES

MAP CODE	VEGETATION FORMS	DOMINANT SPECIES
Swamp		
S1	**h,ts,gc**	Willow Trees, Black Ash, Dogwood/Willow Shrubs, Mixed Herbs
S2	**ts,ne**	Willow Shrubs, Grasses
S3	**h,ts,ne**	Willow Trees, Dogwood/Willow Shrubs, Grasses
S4	**h,ne**	Willow Trees, Grasses
S5	**ts,re,ne**	Willow Shrubs, Cattails, Grasses
S6	**h,re**	Willow Trees, Cattails
Marsh		
M1	**re**	Cattails
M2	**ne**	Grasses/Sedges
M3	**ne,re**	Grasses, Cattails
W4	**su**	Pondweeds
W5	**f**	Yellow Water Lily/White Water Lily
M6	**re,ff**	Cattails, Duckweed
W7	**u**	Unvegetated Open Water (<2m deep)

Table A. Wetland Classification Map Legend for Ontario south of the Precambrian Shield. Legend depicts symbols for showing wetland type and interspersion of vegetation forms.

WETLAND TYPE (FORMATION)*	SWAMP S	BOG B FEN F	MARSH M	
SUBTYPE (SUBFORMATION)*		OPEN O TREED T		OPEN WATER W
VEGETATION FORM (PHYSIOGNOMIC GROUP)* based mainly on height characteristics	Deciduous h Coniferous c Tall Shrub (thicket) ts Dead Tree dh,dc Dead Shrub ds	Shrub-rich sr Tall Shrub ts Low Shrub ls Dead Shrub ds Moss m Narrow-leaved Emergent ne	Narrow-leaved Emergent ne Low Shrub ls Robust Emergent re Broad-leaved Emergent be Shrub-rich sr	Free-floating Plants ff Floating Plants (rooted) f Submerged Plants su Unvegetated u

OTHER MODIFIERS:

Flooded	(F)
Cutover/recent secondary succession	(C)
Post-fire succession	(P)
Grazed	(G)
Impounded	(I)
Drained, or affected by drains through the area	(D)
etc.	

Abbreviations are in order of Subtype/Vegetation Form/Wetland Type/Other modifier (eg. $O^5ts^{40}F(D)$), except for Open Water Marsh where W is substituted for M (eg. suW (not WsuM)). Superscripts refer to cover percentages of the particular Subtype and Vegetation Form. Subscripts refer to percentage makeup of complexed Wetland Types (eg. $neM_{40}tsS_{30}dS_{30}$).

The generic vegetation form category "shrub-rich" is used to include both tall shrub and low shrub groups where height of shrub cover is not discernible.

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* Categories used by Peatlands Inventory Project (Riley 1983)

APPENDIX VI.

GUIDELINES FOR THE ACCURATE USE OF A DIGITIZER, PLANIMETER AND A DOT GRID

(1) Digitizer

(a) Place the map to be measured within the plus and minus signs which are marked on the digitizer table;

(b) Tape the edges of your map to the table;

(c) Switch on the digitizer. The screen will display three columns. The first column is the x coordinate; the second is the y coordinate. Place the cursor on the area to be measured and keep it flat on the table at all times in order to measure the x and y coordinates.

(d) Enter the scale by pressing "SCL" and then the numbers. Press the "RETURN" key.

(e) Mark a definite starting point on the boundary. To start the area measurement press A on the cursor or type "ARE" on the keyboard. The digitizer should show "START AREA" on the screen.

(f) Press "D" on the cursor while holding the hairline on the marked starting point. The left red light should start blinking. If it does not, press "RST" and the "RETURN" key twice followed by "ARE".

(g) Move the cursor crosshair along the perimeter of the area to be measured and return to the origin.

(h) The red light will stop flashing when the starting point is reached. If the origin cannot be found, press C on the cursor. The area will automatically be closed by a straight line between the origin and the present position of the crosshair.

(i) The area measured appears as a number on the y coordinate of the screen. It is in sq. km.

Eg.	X Coordinate	y Coordinate	3rd Column
	+ 000 - 018	+ 016 - 758	00000

This indicates that the area = 16.758 sq. km or 1675.8 hectares.

For the next calculation press F on the cursor or type RST on the keyboard. To discontinue the area calculations press 3 on the cursor or type PNT on the keyboard.

(j) To calculate lengths, place cursor at beginning of line to be measured and type LEN on the keyboard. If the cursor is not at the beginning of the line before LEN is typed, the length will be inaccurate. The display will show "STARTING POINT - LENGTH". Press D to start digitizing. At the end of the length, press C and the length will be displayed.

To perform another length calculation, put the crosshair of the cursor at the beginning of the next length and press F on the cursor or type RST on the keyboard. Again, you must put the cursor at the beginning of the line before pressing F or RST or else the answer will be inaccurate. The "STARTING POINT - LENGTH" will be displayed again, so continue as before.

To discontinue the length calculations, press 3 on the cursor or type PNT on the keyboard.

(2) Planimeter Method

If this method is to be used then it is imperative that the user be properly trained by an experienced person.

The planimeter described here is the KOIZUMI roller planimeter with a zero setting device (J.A. PAT. 481120, 890067, 507065). Proceed as follows:

(a) lay the velum paper with the shiny surface facing down on top of a sheet of large stiff paper to prevent the planimeter from slipping sideways;

(b) set the tracer arm at 149.0. This gives a 1:1 reading in square cm;

(c) if the area to be measured is wider than 20 cm, divided it into 20 cm strips. The area of these sections is ascertained and added together to give the total area;

(d) place the planimeter in the centre of one of the 20 cm wide strips;

(e) prior to measuring, circulate the tracing magnifier in a clockwise motion along the border within the 20 cm strip to ensure that it can reach the entire border without causing the planimeter pole roller to move sideways. The roller should only move in a vertical direction along the velum;

(f) mark a starting point on the border. Hold the centre point of the tracing magnifier on the starting point and set the planimeter reading at zero;

(g) hold the tracing magnifier in two hands and move the centre point along the border in a clockwise direction, and when reaching the starting point read the appropriate units on the dials;

(h) the total is read in square centimeters. However, for a scale 1:10,000 this figure remains the same when converted to hectares.

For example, at a reading of 1473 the number of hectares would equal 147.3.

(3) Dot Grid Method

(a) Lay the velum on a white background paper or a light table in order to improve the visibility of dots. Secure with masking tape.

(b) The number of dots enclosed in the area to be measured can now be counted.

If your map has a scale of 1:10,000 then multiply the number of dots by 0.064516.

APPENDIX VII

KEYS TO WETLAND CLASSIFICATION IN SOUTHERN ONTARIO

(Adapted from Riley 1983)

The Ontario Geological Survey of the Ministry of Natural Resources has prepared keys to facilitate classification and mapping of peatlands as part of their survey of the peat and peatland resources across Ontario. This type of classification system has been in use by field workers for several years, and was modified from the initial system proposed by Zoltai et al. (1975), Jeglum et al. (1974), and Jeglum and Boissonneau (1977), with the addition of published and unpublished data from elsewhere in the province (e.g. Maycock (in prep.) in the south, and others). The following keys are adapted for the Wetland Evaluation System from abbreviated keys used by the Peatland Inventory Project in southern Ontario.

The classification system is hierarchical so that it can be used at several levels of detail depending on the user's need or on the data available.

In the Wetland Evaluation System, classification mapping is conducted to the level of vegetation form group, i.e.

	Example:
1. WETLAND TYPE	1. BOG
1a Subtype	1a Treed
2. VEGETATION FORM GROUP	2. low shrub

Subtype is simply a modifier of wetland type used in bogs and fens to indicate presence/density of trees, or of open water in marshes. The composition of vegetation communities (combinations of vegetation forms present) are recorded by field crews, but are not usually mapped in detail.

Superscripts can be used to show percentage cover values of particular species or of vegetation form, <u>where suitable data are available</u>, e.g. Treed22 low shrub^{42} Bog, or T^{22} ls^{42} B. Otherwise leave numbers out, e.g. TlsB. Percentage cover values are not necessary to complete a wetland evaluation. Abbreviations are always in the order of Subtype (where applicable)-Vegetation Form Group-Wetland Type, except for Open Water Marshes where the subtype symbol W simply replaces the wetland type symbol M, e.g. Open Water floating plant Marsh, or WfM, is simply written fW. Other modifiers reflecting site history may also be added, e.g. (P) for post-fire succession follows wetland type, TlsB(P).

The following keys are presented:

Key to Wetland Types
Key to Subtypes
A. Bogs, Fens
B. Marsh
Key to Vegetation Form Groups
A. Swamps
B. Bogs, Fens
C. Marsh and Open Water Marsh
Other Modifiers

KEY TO WETLAND TYPES

1. Predominantly ombrotrophic or weakly minerotrophic peatlands, developed on peat (surface water pH usually <5.5, unless seasonally dried out); accumulation of poorly decomposed peat >30 cm dominated surficially by sphagnum peat; isolated from mineral soil water movement; ombrotrophic peatlands usually have ground water pH's <4.5, with Ca levels <2 ppm.

Forming a level, gradually raised, or sloping surface with a (usually) hummock-hollow topography; usually with a continuous carpet of mosses dominated by Sphagnum spp. (particularly S. fuscum in hummock phase); usually with a ground cover of graminoids (narrow-leaved emergents) or of mostly ericaceous shrubs; without trees or with short trees (<10m) with more or less open canopy (usually <25%, Picea mariana, or Larix laricina in transitional sites).

. . . . . BOG (B)

1. Predominantly minerotrophic wetland, developed on graminoid, woody or "brown moss" peat, or, if with abundant sphagnum at the surface, not underlain with a continuous horizon of poorly decomposed sphagnum peat >30 cm; sites influenced by flowing or standing mineral soil water.

2. Minerotrophic wetlands, heavily wooded or with shrub thickets over 2m tall >25% cover; usually with hummocky surface broken by wet interstitial hollows, or relatively flat with many spring-flooded pools; with >25-30% canopy cover of trees (or shrubs greater than 2 m tall in tall shrub (thicket SWAMP); substrate of mixtures of transported mineral and organic sediments, or peat (usually woody or with sphagnum surface) deposited in situ; often seasonally flooded or flooded by beaver dams, or with interstitial hollows of standing water and hummocks restricted to deadfall or tree/ shrub bases; flooding can decrease tree density to less than 25% by dieback; (distinguished from the rarer High Density TREED BOG by its location on the wetter edges of peatlands, or by the occurrence of an understorey of Alnus rugosa or Salix spp., or surficial substrate of sphagnum peat <30 cm, or by the more vigorous growth of trees, often those over 10 cm DBH >25% cover).

. . . . . SWAMP (S)

(Occasionally some heavily treed conifer peatlands keying out as SWAMP differ from typical swamps in occurring on deep, more or less dry peats, and having such dense canopy closure that almost no shrub or ground cover persists. Larix laricina has been noted as the dominant species on such sites in both northern and southern Ontario. Because of the density of tree growth and dryness, they may be better classified as PEAT FOREST (non-wetland).

2. Open or treed minerotrophic wetlands with level or depressional surfaces except for low hummocks or ridges; dominated by sedges, reeds, cattails, grasses and/or (mostly) non-ericaceous shrubs; tree cover may reach 25% in FENS (Larix laricina, Thuja occidentalis) but is usually less than 10 m in height and has an understorey of low shrubs and/or narrow-leaved emergents rather than tall alder or willow shrubs; pools of open water or drainage tracks may be present.

Open, relatively uniform and consolidated surface, often patterned in northern Ontario but more homogeneous physiognomically in the south and often with surface growth of clumped cedar; vegetation consists of short sedges and grasses, and a variable layer of (mostly) non-ericaceous shrubs and trees; often associated with the so-called "brown mosses" (Campylium stellatum, Drepanocladus revolvens, Tomenthypnum nitens, Scorpidium scorpioides, Palludella squarrosa, Calliergon giganteum), or "marl peat" if pH's F5.5, or by Sphagnum spp. if pH is 5.0 to 6.0; usually not connected to OPEN WATER or open drainage systems except in infilling 'kettle' peatlands; root or stump hummocks are common, and hollows may or may not have shallow water over the peat.

. . . . . FEN (F)

(In many TREED FENS, conditions are only weakly minerotrophic, and both BOG and FEN indicator species exist. Often sphagnum and black spruce are present, particularly in the 'hummock' phase, and a site will appear to be transitional in terms of succession from FEN to BOG. Such formations may be termed TREED Poor FEN (TPF)).*

. . . . . Poor FEN (PF)*

Unconsolidated, open, flat to depressional surface with herbaceous emergent sedges, grasses, cattails and reeds interspersed in standing water with small pools and channels or patches of mineral soil exposed during seasonal water drawdowns; open water portions E2 m deep usually with floating, submergent or partly emergent vegetation, and often associated with open streams or rivers, flowing lakes, or glacial depressions; can be contiguous to or grade into Tall Shrub (Thicket) SWAMP with a shrub element up to 25% cover.

. . . . . MARSH (M)

* Evaluate as FEN

2. KEY TO SUBTYPES

A. Bog and Fen

1. Cover by tree species > 135 cm tall < 10%
. . . . . OPEN (O^x)

(Abbreviated to O^x if a superscript annotation of canopy cover percentage is available; for example, O^8).

1. Cover by tree species > 135 cm tall > 10% (rarely to 50%); trees species > 10 cm DBH < 25% cover.
. . . . . TREED (T^x)

(Abbreviated to T^x if a superscript annotation of canopy cover percentage is available; for example, T^{22}: otherwise refer to 2).

2. 10-15% cover by tree species > 135 cm tall
. . . . . Low Density TREED (T(ld))

2. 15-25% cover by tree species > 135 cm tall; > 25% cover on occasion.
. . . . . Medium Density TREED (T(md))

Where cover by tree species >135 cm tall >30% cover, and trees over 10 cm DBH >25% cover, the stand may usually be considered to be SWAMP. High Density TREED BOG (T(hd)B; canopy >25%) is a much less frequent type in Ontario, occurring in the central (or raised) areas of well developed bogs, with less vigorous tree growth than Conifer SWAMP. It is not associated with *Alnus rugosa* or *Salix* spp. which occupy more minerotrophic and wetter areas of peatland edges and drains. High Density TREED BOG is usually dominated by *Ledum groenlandicum* in the shrub storey, and is transitional to the *L. groenlandicum*-type of *Picea mariana* SWAMP.

NOTE that in the Wetland Evaluation System (Part I, 1.2.2) cover by a vegetation form must be approximately 25% in order for the form to be evaluated as a distinct part of the vegetation community. Therefore trees in Open and Low Density treed areas, while indicated on the wetland map (O, T), are not evaluated as a distinct form when scoring vegetation community composition.

B. Marsh

Open water covering at least 75% of aquatic basin; <2 m deep and associated with flowing or standing lakes, rivers, or ponds; usually with floating, submergent or partly emergent plants, or unvegetated.
. . . . . OPEN WATER MARSH (W)

3. KEY TO VEGETATION FORM GROUPS

A. Swamp

1. Tree species dominant

2. Conifers dominant (Picea mariana, Larix laricina, Thuja occidentalis).

. . . . . Conifer (c)

2. Deciduous (hardwood) trees dominant (Fraxinus nigra, F. pennsylvanica, Populus spp., Acer saccharinum, A. rubrum, Ulmus americana, Salix nigra, Carya spp., Quercus macrocarpa, Q. palustric, Nyssa sylvatica, etc.)

. . . . . Deciduous (h)

(Note that mixed swamps may be classified as follows: conifer (dominant)-deciduous (subdominant) Swamp as chS, deciduous (dominant)-conifer (subdominant) Swamp as hcS, and superscripts may be used to indicate respective cover percentages; eg. $h^{35}c^{15}S$).

2. Standing dead trees dominant (and tree stumps 2 m or more on height)

. . . . . Dead Trees (dh,dc)

1. Shrub species dominant

3. Tree species less than 25% cover and shrub species over 2m tall >25% (Alnus rugosa, Salix petiolaris, other Salix spp., Betula pumila var. glandulifera, Cornus stolonifera, C. racemosa, Rhus vernix, Cephalanthus occidentalis, Ilex verticillata, etc); grades into Shrub-rich MARSH in southern Ontario, from which it can be distinguished by its firm, more or less consolidated peat surface, its relative lack of open drainways and streams, and its denser and taller shrub cover; often referred to as "shrub carr" or "thicket".

. . . . . Tall Shrub (ts)

3. Standing dead shrubs dominant (and tree stumps <1m in height)

. . . . . Dead Shrubs (ds)

B. BOG and FEN

1. Shrubs present, as low or dwarf shrubs >25% cover or tall shrubs 10-30(40)% cover. Where the height of shrub cover is not discernible from air photo interpretation, the generic Vegetation Form Group 'Shrub-rich' (sr) can be used, and understood to include both tall shrub and low shrub groups. In very few cases should more than a single vegetation form modifier be applied; where more than one may be considered applicable, the shrub storey takes precedence over the narrow-leaved emergent/herb and moss layers, the narrow-leaved emergent/herb layer takes precedence over moss, and the latter is used only where neither shrub nor narrow-leaved emergent/herb layer is significant by the definitions used below.

2. Shrubs over 135 cm tall 10-30 (40)% cover; shrub species include Chamaedaphne calyculata (B,F), Kalmia angustifolia (B), Thuja occidentalis (F, dwarf), Betula pumila var. glandulifera (F), Salix pedicellaris (F), Myrica gale (F), Aronia prunifolia (B,F), Nemopanthus mucronata (B), Vaccinium corymbosum (B), (B and F indicate general BOG or FEN tendencies).
. . . . . Tall Shrub (ts)

2. Shrubs, where present, mostly less than 135 cm tall (or with less than 10% cover by shrubs greater than 135cm); low candelabra or layered black spruce less than 135 cm would be included in percentage estimates of shrub cover; these shrubs form greater than 25% cover and are the main visual impact but sites may also have a significant narrow-leaved emergent component; includes most of the shrub species listed in couplet 1, with the addition of dwarfed candelabra Picea mariana (B), Ledum groenlandicum (B,F), Andromeda glaucophylla (B,F), Vaccinium myrtilloides (B), Rhamnus alnifolius (F), Potentilla fruticosa (F), Gaylussacia baccata (B), (B and F refer to general BOG or FEN tendencies). 'Semi-shrubs' such as Vaccinium oxycoccus, Rubus pubescens, Gaultheria hispidula, should not be included in shrub cover values.
. . . . . Low Shrub (ls)

2. Standing dead shrubs dominant, >25% cover
. . . . . Dead Shrub (ds)

1. Shrubs either not present or present at cover values less than indicated above.

3. Conspicuous narrow-leaved emergent layer (sedges, grasses, reeds) > 25% cover; narrow-leaved emergent cover exceeds shrub cover percentage: characteristic species are Carex aquatilis (F), C. chordorrhiza (F), C. diandra (F), C. interior (F), C. lasiocarpa (F), C. limosa (B,F), C. livida (F), C. oligosperma (B), C. microglochin (B), C. pauperculus (B), C. rostrata (F), Equisetum fluviatile (F), Eriophorum spissum (B), E. viridicarinatum (F), Scirpus cespitosus (F,B), S. hudsonianus (F), Triglochin maritimum (F), (B and F refer to general BOG and FEN tendencies); included in this layer are peatland forbs and 'semi-shrubs' such as Vaccinium oxycoccus (B,F), Rubus chamaemorus (B), R. acaulis (F,B), and Gaultheria hispidula (B,F). Also known as graminoids.
. . . . . Narrow-leaved Emergent (ne)

3. Sphagnum moss or other mosses dominant at surface; shrubs, herbs and narrow-leaved emergents <25% cover. OPEN sphagnum BOG and TREED sphagnum FEN may not occur in southern Ontario.
. . . . . Moss (m)

C. MARSH

1. Sedges, grasses, reeds, cattails or broad-leaved emergents dominant; may occur on mineral, muck, well-decomposed graminoid peat, or layering of these substrate layers.

   2. Stands dominated by sedges, grasses (less than 1.8 m in height)
      . . . . . Narrow-leaved Emergents (ne)

   2. Stands dominated by reeds or cattails (1.5 m - 3 m in height)
      . . . . . Robust Emergents (re)

   2. Stands dominated by broad-leaved emergents (less than 1m in height)
      . . . . . Broad-leaved Emergents (be)

1. Sedges, grasses, reeds or cattails present but dominated by shrub species (e.g. _Decodon verticillatus_, _Cephalanthus occidentalis_); usually the more or less unconsolidated edges of tall shrub (thicket) Swamp or Marsh; a minor physiognomic unit in southern Ontario, grading into tall shrub (thicket) Swamp in extreme southwestern Ontario where _Cephalanthus occidentalis_ grows much larger.

   . . . . . Shrub-rich (sr)

1. Dominated by floating or submergent vegetation

   3. Dominated by non-rooted, free-moving vascular hydrophytes floating on the water surface
      . . . . . Free-floating Plants (ff)

   3. Dominated by rooted, vascular hydrophytes with leaves floating horizontally on the water surface
      . . . . . Floating Plants (f)

   3. Dominated by hydrophytes that are entirely submerged beneath the water surface, except for flowering parts in some species
      . . . . . Submerged Plants (su)

1. Largely unvegetated marsh <2 m deep (not an actual vegetation form, but is included for use in mapping)
   . . . . . Unvegetated (u)

4. OTHER MODIFIERS

Modifiers reflecting site history can add significantly to the meaning of mapped or reported Vegetation Form Groups; modifiers should be placed in brackets after the abbreviation of Wetland Type.

Flooded by beaver, roadway or other (e.g. hS(F))	(F)
Cutover and/or recent secondary succession	(C)
Post-fire succession	(P)
Grazed	(G)
Drained, or affected by drains through the area	(D)

A schematic legend relating Wetland Types and Subtypes to usual dominant Vegetation Form Groups is given in Appendix V.

APPENDIX VIII.

INSTRUCTIONS FOR OBTAINING CONDUCTIVITY INFORMATION

(Source: Dodge et al. 1983)

Testing for Total Dissolved Solids

The concentration of total dissolved solids is calculated by converting specific conductance measurements. Specific conductance is a measure of the capacity to conduct an electric current. The specific conductance property is related to the total concentration of ionized substances in the water and the temperature at which the measurement was made. Any particle which is ionized, including clay particles, is measured.

Total dissolved solids are obtained by referring to Table A using the specific conductance reading and the temperature at which the measurement was made. Total dissolved solids are considered a very important parameter in estimating fish productivity capabilities. In general, total dissolved solid readings for the Precambrian Shield range from 10 to 100 mg/l while readings in southern Ontario range from 150 to 500 mg/l. In highly industrialized areas total dissolved solids may range up to 2000 mg/l.

Measuring Specific Conductance

There are a number of conductivity measuring bridges (See Figure A) available with a variety of cell types (illustrated is the MC3). The Lisle-Metrix MC3 and C41 models are the recommended units. It is important that the user becomes familiar with the unit before proceeding to take measurements.

The battery operated transistorized resistance measuring bridge is housed in a case and can be balanced manually. Thermometers are either a separate part of the unit or built-in.

To determine specific conductance with the MC3 Conductivity Bridge, the following procedure should be followed.

To Test the Instrument (see figure Ai)

(1) (a) Plug into the meter case the clean, dry conductivity cell.

(b) Set the range selector switch to the marked 'test' position.

(c) Hold down the 'ON' button and slowly rotate the bridge balance control knob until the balance indicator is in the central or zero position. The control knob terminal should be at the uppermost point of the scale - 10. If balance is not obtained at this position, then the balance control know must be removed and reaffixed to its shaft.

(2) Remove the conductivity cell from the unit (see figure Aii)

(3) Rinse the conductivity cell with the water to be tested, at least three times. Do not wet the electrodes.

(4) Fill the cell with the water to be tested until it is up to the top edge of the cell bore. Excess sample size causes no difficulty, whereas insufficient sample prevents full contact of the solution with the top electrode and results in incorrect readings.

(5) Plug the filled cell into the unit.

(6) Determine and record the temperature of the water in the cell. If the sample temperature is taken with a hand controlled thermometer, move it gently 'up and down' in the centre of the cell to ensure uniform temperature and removal of any air bubbles present.

(7) Remove the thermometer from the cell in order to obtain the correct specific conductance reading.

(8) Set the selector switch to the 'XI' range and the balance pointer knob to 100. Depress the 'ON' switch briefly.

(a) If the balance indicator deflects to the right, the sample conductivity is below 100 micromhos/cm - hold down the 'ON' switch and turn the control knob slowly (anti-clockwise) until the balance indicator is central. The conductivity of the sample in umhos/cm is shown on the scale at the point of the control knob (see figure Aiii).

(b) If the balance indicator deflects to the left, the sample conductivity is above 100 micromhos/cm. Set the selector switch to the 'X100' range and the balance pointer knob to the 100 position.

Hold down the 'ON' key and turn the balance control knob slowly (anti-clockwise) until the balance indicator is central. The scale reading must now be multiplied by 100 to obtain the conductivity of the sample in umhos/cm (see figure Aiv).

(9) Note and record specific reading and temperature.

Note: The scale of the meter is logarithmic, i.e. the scale is not in equal increments. Therefore, the most accuracy hoped to be obtained is 1/2 of each of the indicated points on the scale. The conductivity readings on the T.D.S. conversion table correspond to all the possible readings on the meter. Any other readings can only be obtained by guess-work. In other words, if the control knob falls somewhere between two increments on the scale, the halfway mark is used as per the table.

(10) Clean the cell by washing thoroughly with the cleaning brush provided. Shake out any residual water. Never dry the cell bore with a cloth or other material.

(11) Wipe dry the exterior of the cell and return it to the case with the conductivity bridge.

Using the Lisle-Metrix Minibridge (see figure Av)

(1) Ensure that the measuring cell is perfectly clean. Clean the cell with a bristle brush and warm water, if necessary.

(2) Measure the temperature of the water sample. Record this temperature on the summary sheet.

(3) Set the temperature knob at 25°C.

(4) Switch the range selector to "HI" and balance the meter needle by slowly rotating the large knob. If the meter will not balance at the centre, turn the range selector to "LO" and balance the meter.

(5) Read the specific conductance on the appropriate scale as indicated by the hair line on the balancing knob.

(6) The instrument is functioning properly when the meter balances with the cell disconnected, the selector switch at the test position (at the arrow), the red light is on and the balancing know pointer is at 1000.

N.B. If the dial is set to the actual water temperature, then the meter gives the conductivity at 25°C (i.e. standard conductivity). If the dial is set to 25°C, then the meter gives the conductivity at the actual temperature of the water sample. Use the latter method and remember to record the water temperature.

Maintenance and Care

To Cleanse the Cell:

1) Place in partially filled water container.

2) Remove the bottom plastic stopper from the cell by pushing it out with a blunt object.

3) Use the cleansing brush to scrub the bore of the cell.

IF DRY PATCHES APPEAR QUICKLY, THE CLEANING OPERATION MUST BE REPEATED.

4) Use Javex liquid cleaner to remove hard-to-remove coatings of carbonate salts.

Replace battery when the balance indicator does not have an extremely sharp and precise movement close to the balance point.

Dry the interior of the Conductivity Bridge case periodically and always subsequent to using in humid or damp weather and before putting in storager. Dampness breeds corrosion.

N.B. Remove batteries from unit before putting in storage.

Total Dissolved Solids

To determine total dissolved solids from initial specific conductance readings, refer to the Conductivity/-T.D.S. Conversion Chart (Table A).

1) Locate the 'initial specific conductance' in the column on the 'Y' axis of the chart.

2) Locate the accompanying cell temperature from the series listed along the 'X' axis.

3) Record the T.D.S. reading found at the intersection of two imaginary lines drawn horizontally and vertically from the Y and X axes respectively.

e.g. An initial specific conductance of 60 umhos/cm and cell temperature of 22°C would give a T.D.S. reading of 42.5 mg/l.

If the conductivity or cell temperature readings do not fall within the range of the chart, the T.D.S. can be calculated by using the following formula:

$$\text{T.D.S.} = \left(\frac{\text{(Initial Conductivity umhos/cm)}}{1 + (0.02\ (\text{Cell temp. } ^{o}\text{C} - 25))} \right) \times 0.666$$

Note: In a number of cases, the total alkalinity reading will be greater than the total dissolved solids (T.D.S.) reading. Since T.D.S. is a measure of all the ions in the solution and total alkalinity is a measure of carbonates, bicarbonates and hydroxides in theory T.D.S. will always be greater than total alkalinity. Then why is there a discrepancy? Simply, the sensitivities of the two methods are different.

CELL TEMPERATURE °C

INITIAL SPECIFIC CONDUCTANCE umhos/cm	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
15.0	17.2	16.6	16.1	15.6	15.1	14.7	14.3	13.9	13.5	13.1	12.8	12.5	12.2	11.9	11.6	11.4	11.1	10.9	10.6	10.4	10.2	10.0	9.8	9.6	9.4	9.3	9.1	15.0
15.5	17.8	17.2	16.6	16.1	15.6	15.2	14.7	14.3	13.9	13.6	13.2	12.9	12.6	12.3	12.0	11.7	11.5	11.2	11.0	10.8	10.5	10.3	10.1	9.9	9.7	9.6	9.4	15.5
16.0	18.4	17.8	17.2	16.6	16.1	15.7	15.2	14.8	14.4	14.0	13.7	13.3	13.0	12.7	12.4	12.1	11.8	11.6	11.3	11.1	10.9	10.7	10.4	10.2	10.1	9.9	9.7	16.0
16.5	18.9	18.3	17.7	17.2	16.6	16.2	15.7	15.3	14.8	14.5	14.1	13.7	13.4	13.1	12.8	12.5	12.2	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.0	16.5
17.0	19.5	18.9	18.3	17.7	17.2	16.6	16.2	15.7	15.3	14.9	14.5	14.2	13.8	13.5	13.2	12.9	12.6	12.3	12.0	11.8	11.6	11.3	11.1	10.9	10.7	10.5	10.3	17.0
17.5	20.1	19.4	18.8	18.2	17.7	17.1	16.6	16.2	15.7	15.3	14.9	14.6	14.2	13.9	13.6	13.2	12.9	12.7	12.4	12.1	11.9	11.7	11.4	11.2	11.0	10.8	10.6	17.5
18.0	20.7	20.0	19.3	18.7	18.2	17.6	17.1	16.6	16.2	15.8	15.4	15.0	14.6	14.3	13.9	13.6	13.3	13.0	12.8	12.5	12.2	12.0	11.8	11.5	11.3	11.1	10.9	18.0
18.5	21.2	20.5	19.9	19.3	18.7	18.1	17.6	17.1	16.6	16.2	15.8	15.4	15.0	14.7	14.3	14.0	13.7	13.4	13.1	12.8	12.6	12.3	12.1	11.8	11.6	11.4	11.2	18.5
19.0	21.8	21.1	20.4	19.8	19.2	18.6	18.1	17.6	17.1	16.6	16.2	15.8	15.4	15.1	14.7	14.4	14.1	13.8	13.5	13.2	12.9	12.7	12.4	12.2	11.9	11.7	11.5	19.0
19.5	22.4	21.6	20.9	20.3	19.7	19.1	18.6	18.0	17.5	17.1	16.6	16.2	15.8	15.5	15.1	14.8	14.4	14.1	13.8	13.5	13.3	13.0	12.7	12.5	12.3	12.0	11.8	19.5
20.0	23.0	22.2	21.5	20.8	20.2	19.6	19.0	18.5	18.0	17.5	17.1	16.6	16.2	15.9	15.5	15.1	14.8	14.5	14.2	13.9	13.6	13.3	13.1	12.8	12.6	12.3	12.1	20.0
22.5	25.8	25.0	24.2	23.4	22.7	22.0	21.4	20.8	20.2	19.7	19.2	18.7	18.3	17.8	17.4	17.0	16.6	16.3	15.9	15.6	15.3	15.0	14.7	14.4	14.1	13.9	13.6	22.5
25.0	28.7	27.7	26.9	26.0	25.2	24.5	23.8	23.1	22.5	21.9	21.3	20.8	20.3	19.8	19.4	18.9	18.5	18.1	17.7	17.3	17.0	16.6	16.3	16.0	15.7	15.4	15.1	25.0
27.5	31.6	30.5	29.5	28.6	27.7	26.9	26.2	25.4	24.7	24.1	23.5	22.9	22.3	21.8	21.3	20.8	20.3	19.9	19.5	19.1	18.7	18.3	18.0	17.6	17.3	17.0	16.6	27.5
30.0	34.4	33.3	32.2	31.2	30.3	29.4	28.5	27.7	27.0	26.3	25.6	25.0	24.4	23.8	23.2	22.7	22.2	21.7	21.3	20.8	20.4	20.0	19.6	19.2	18.8	18.5	18.2	30.0
32.5	37.3	36.1	34.9	33.8	32.8	31.8	30.9	30.1	29.2	28.5	27.7	27.1	26.4	25.8	25.2	24.6	24.0	23.5	23.0	22.5	22.1	21.6	21.2	20.8	20.4	20.0	19.7	32.5
35.0	40.2	38.8	37.6	36.4	35.3	34.3	33.3	32.4	31.5	30.7	29.9	29.1	28.4	27.7	27.1	26.5	25.9	25.3	24.8	24.3	23.8	23.3	22.9	22.4	22.0	21.6	21.2	35.0
37.5	43.1	41.6	40.3	39.0	37.8	36.7	35.7	34.7	33.7	32.9	32.0	31.2	30.5	29.7	29.0	28.4	27.7	27.1	26.6	26.0	25.5	25.0	24.5	24.0	23.6	23.1	22.7	37.5
40.0	45.9	44.4	43.0	41.6	40.4	39.2	38.1	37.0	36.0	35.1	34.2	33.3	32.5	31.7	31.0	30.3	29.6	29.0	28.3	27.7	27.2	26.6	26.1	25.6	25.1	24.7	24.2	40.0
42.5	48.8	47.2	45.7	44.2	42.9	41.6	40.4	39.3	38.2	37.2	36.3	35.4	34.5	33.7	32.9	32.2	31.4	30.8	30.1	29.5	28.9	28.3	27.8	27.2	26.7	26.2	25.7	42.5
45.0	51.7	49.9	48.3	46.8	45.4	44.1	42.8	41.6	40.5	39.4	38.4	37.5	36.5	35.7	34.8	34.1	33.3	32.6	31.9	31.2	30.6	30.0	29.4	28.8	28.3	27.8	27.2	45.0
47.5	54.5	52.7	51.0	49.4	47.9	46.5	45.2	43.9	42.7	41.6	40.6	39.5	38.6	37.7	36.8	35.9	35.1	34.4	33.7	33.0	32.3	31.6	31.0	30.4	29.8	29.3	28.8	47.5
50.0	57.4	55.5	53.7	52.0	50.5	49.0	47.6	46.2	45.0	43.8	42.7	41.6	40.6	39.6	38.7	37.8	37.0	36.2	35.4	34.7	34.0	33.3	32.6	32.0	31.4	30.8	30.3	50.0
55.0	63.2	61.0	59.1	57.2	55.5	53.9	52.3	50.9	49.5	48.2	47.0	45.8	44.7	43.6	42.6	41.6	40.7	39.8	39.0	38.2	37.4	36.6	35.9	35.2	34.6	33.9	33.3	55.0
60.0	68.9	66.6	64.5	62.4	60.5	58.8	57.1	55.5	54.0	52.6	51.2	49.9	48.7	47.6	46.5	45.4	44.4	43.4	42.5	41.6	40.8	40.0	39.2	38.4	37.7	37.0	36.3	60.0
65.0	74.6	72.1	69.8	67.6	65.6	63.7	61.8	60.1	58.5	57.0	55.5	54.1	52.8	51.5	50.3	49.2	48.1	47.1	46.1	45.1	44.2	43.3	42.4	41.6	40.8	40.1	39.4	65.0
70.0	80.4	77.7	75.2	72.8	70.6	68.6	66.6	64.7	63.0	61.3	59.8	58.3	56.9	55.5	54.2	53.0	51.8	50.7	49.6	48.6	47.6	46.6	45.7	44.8	44.0	43.2	42.4	70.0
75.0	86.1	83.2	80.6	78.0	75.7	73.5	71.4	69.4	67.5	65.7	64.0	62.4	60.9	59.5	58.1	56.8	55.5	54.3	53.1	52.0	51.0	49.9	49.0	48.0	47.1	46.3	45.4	75.0
80.0	91.9	88.8	85.9	83.2	80.7	78.4	76.1	74.0	72.0	70.1	68.3	66.6	65.0	63.4	62.0	60.5	59.2	57.9	56.7	55.5	54.5	53.3	52.2	51.2	50.3	49.3	48.4	80.0
85.0	97.6	94.3	91.3	88.5	85.8	83.2	80.9	78.6	76.5	74.5	72.6	70.8	69.0	67.4	65.8	64.3	62.9	61.5	60.2	59.0	57.8	56.6	55.5	54.4	53.4	52.4	51.5	85.0
90.0	103.3	99.9	96.7	93.7	90.8	88.1	85.6	83.2	81.0	78.9	76.8	74.9	73.1	71.4	69.7	68.1	66.6	65.2	63.8	62.4	61.2	59.9	58.8	57.6	56.5	55.5	54.5	90.0
95.0	109.1	105.4	102.0	98.9	95.9	93.0	90.4	87.9	85.5	83.2	81.1	79.1	77.2	75.3	73.6	71.9	70.3	68.8	67.3	65.9	64.6	63.3	62.0	60.8	59.7	58.6	57.5	95.0
100.0	114.8	111.0	107.4	104.1	100.9	97.9	95.1	92.5	90.0	87.6	85.4	83.2	81.2	79.3	77.4	75.7	74.0	72.4	70.9	69.4	68.0	66.6	65.3	64.0	62.8	61.7	60.5	100.0
125.0	143.5	138.7	134.3	130.1	126.1	122.4	118.9	115.6	112.5	109.5	106.7	104.1	101.5	99.1	96.8	94.6	92.5	90.5	88.6	86.7	84.9	83.2	81.6	80.0	78.5	77.1	75.7	125.0
150.0	172.2	166.5	161.1	156.1	151.4	146.9	142.7	138.7	135.0	131.4	128.1	124.9	121.8	118.9	116.2	113.5	111.0	108.6	106.3	104.1	101.9	99.9	97.9	96.1	94.2	92.5	90.8	150.0
175.0	200.9	194.2	188.0	182.1	176.6	171.4	166.5	161.9	157.5	153.4	149.4	145.7	142.1	138.7	135.5	132.4	129.5	126.7	124.0	121.4	118.9	116.5	114.3	112.1	110.0	107.9	106.0	175.0
200.0	229.7	222.0	214.8	208.1	201.8	195.9	190.3	185.0	180.0	175.3	170.8	166.5	162.4	158.6	154.9	151.4	148.0	144.8	141.7	138.7	135.9	133.2	130.6	128.1	125.7	123.3	121.1	200.0
225.0	258.4	249.7	241.7	234.1	227.0	220.4	214.1	208.1	202.5	197.2	192.1	187.3	182.7	178.4	174.2	170.3	166.5	162.9	159.4	156.1	152.9	149.8	146.9	144.1	141.4	138.8	136.2	225.0
250.0	287.1	277.5	268.5	260.2	252.3	244.9	237.9	231.2	225.0	219.1	213.5	208.1	203.0	198.2	193.6	189.2	185.0	181.0	177.1	173.4	169.9	166.5	163.2	160.1	157.1	154.2	151.4	250.0
275.0	315.8	305.2	295.4	286.2	277.5	269.3	261.6	254.4	247.5	241.0	234.8	228.9	223.4	218.0	213.0	208.1	203.5	199.1	194.8	190.8	186.9	183.1	179.6	176.1	172.8	169.6	166.5	275.0

Table A – CONDUCTIVITY — TDS CONVERSION CHART March 1982

CELL TEMPERATURE °C

INITIAL SPECIFIC CONDUCTANCE umhos/cm

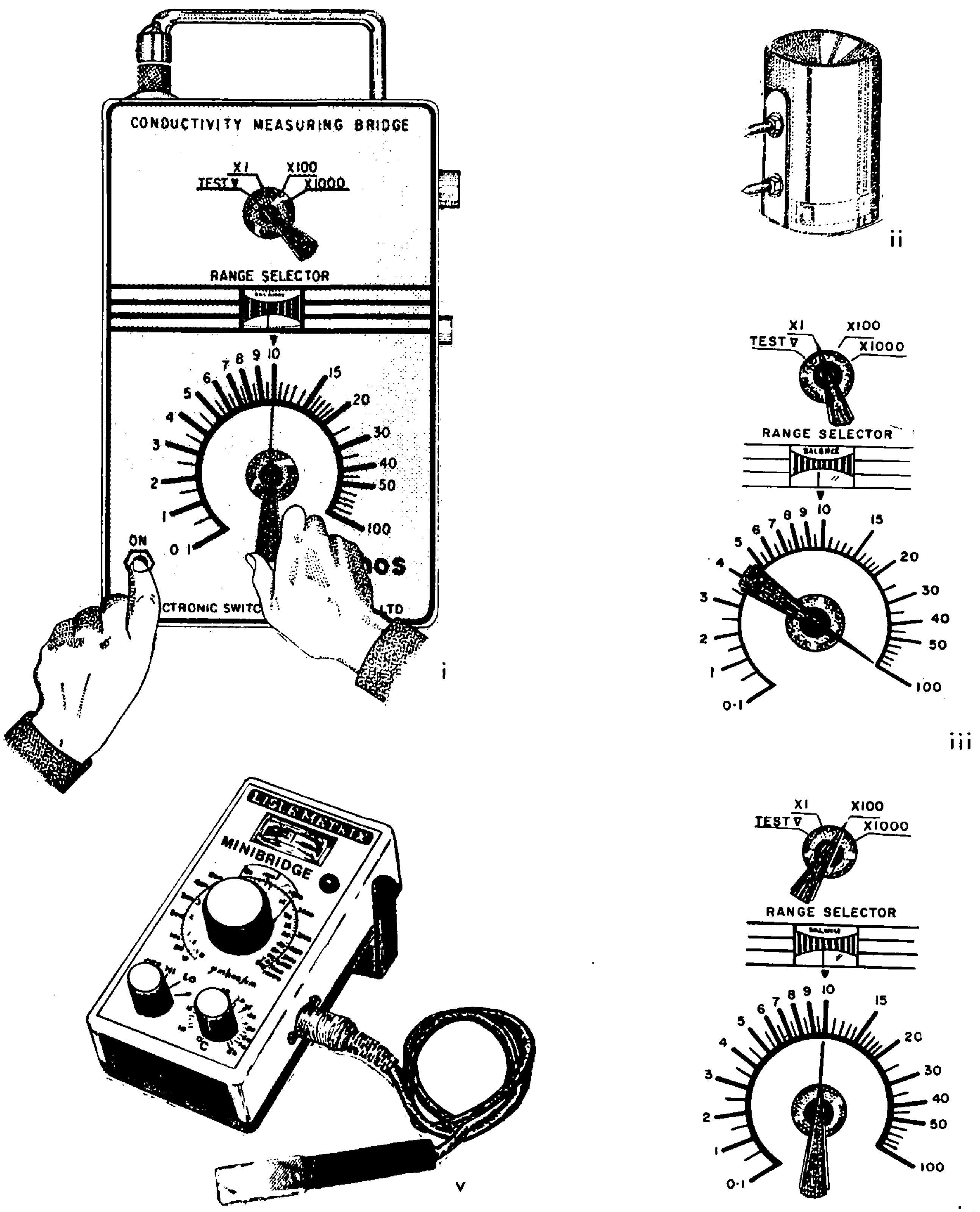
umhos/cm	4	5	6	7	8	9	10	11	12	13	14	15	16
300.0	344.5	333.0	322.3	312.2	302.7	293.8	285.4	277.5	270.0	262.9	256.2	249.7	243.7
325.0	373.2	360.7	349.1	338.2	328.0	318.0	309.2	300.6	292.5	284.8	277.5	270.6	264.0
350.0	401.9	388.5	376.0	364.2	353.2	342.8	333.0	323.7	315.0	306.7	298.8	291.4	284.3
375.0	430.6	416.2	402.8	390.2	378.4	367.3	356.8	346.9	337.5	328.6	320.2	312.2	304.6
400.0	459.3	444.0	429.7	416.2	403.6	391.8	380.6	370.0	360.0	350.5	341.5	333.0	324.9
425.0	488.0	471.7	456.5	442.3	428.9	416.2	404.4	393.1	382.5	372.4	362.9	353.8	345.2
450.0	516.7	499.5	483.4	468.3	454.1	440.7	428.1	416.2	405.0	394.3	384.2	374.6	365.5
475.0	545.4	527.2	510.2	494.3	479.3	465.2	451.9	439.4	427.5	416.2	405.6	395.4	385.8
500.0	574.1	555.0	537.1	520.3	504.5	489.7	475.7	462.5	450.0	438.2	426.9	416.2	406.1
525.0	602.8	582.7	564.0	546.3	529.8	514.2	499.5	485.6	472.5	460.1	448.3	437.1	426.4
550.0	631.6	610.5	590.8	572.3	555.0	538.7	523.3	508.7	495.0	482.0	469.6	457.9	446.7
575.0	660.3	638.2	617.7	598.4	580.2	563.2	547.1	531.9	517.5	503.9	491.0	478.7	467.0
600.0	689.0	666.0	644.5	624.4	605.5	587.6	570.9	555.0	540.0	525.8	512.3	499.5	487.3
625.0	717.7	693.7	671.4	650.4	630.7	612.1	594.6	578.1	562.5	547.7	533.7	520.3	507.6
650.0	746.4	721.5	698.2	676.4	655.9	636.6	618.4	601.2	585.0	569.6	555.0	541.1	527.9
675.0	775.1	749.2	725.1	702.4	681.1	661.1	642.2	624.4	607.5	591.5	576.3	561.9	548.2
700.0	803.8	777.0	751.9	728.4	706.4	685.6	666.0	647.5	630.0	613.4	597.7	582.7	568.5
725.0	832.5	804.7	778.8	754.5	731.6	710.1	689.8	670.6	652.5	635.3	619.0	603.6	588.8
750.0	861.2	832.5	805.6	780.5	756.8	734.6	713.6	693.7	675.0	657.2	640.4	624.4	609.1
775.0	889.9	860.2	832.5	806.5	782.0	759.0	737.4	716.9	697.5	679.1	661.7	645.2	629.5
800.0	918.6	888.0	859.4	832.5	807.3	783.5	761.1	740.0	720.0	701.1	683.1	666.0	649.8
825.0	947.3	915.7	886.2	858.5	832.5	808.0	784.9	763.1	742.5	723.0	704.4	686.8	670.1
850.0	976.0	943.5	913.1	884.5	857.7	832.5	808.7	788.2	765.0	744.9	725.8	707.6	690.4
875.0	1004.7	971.2	939.9	910.5	883.0	857.0	832.5	809.4	787.5	766.8	747.1	728.4	710.7
900.0	1033.4	999.0	966.8	936.6	908.2	881.5	856.3	832.5	810.0	788.7	768.5	749.2	731.0
925.0	1062.2	1028.7	993.6	962.6	933.4	906.0	880.1	855.6	832.5	810.6	789.8	770.1	751.3
950.0	1090.9	1054.5	1020.5	988.6	958.6	930.4	903.9	878.7	855.0	832.5	811.2	790.9	771.6
975.0	1119.6	1082.2	1047.3	1014.6	983.9	954.9	927.6	901.9	877.5	854.4	832.5	811.7	791.9
1000.0	1148.3	1110.0	1074.2	1040.6	1009.1	979.4	951.4	925.0	900.0	876.3	853.8	832.5	812.2
1050.0	1205.7	1165.5	1127.9	1092.7	1059.5	1028.4	999.0	971.2	945.0	920.1	896.5	874.1	852.8
1100.0	1263.1	1221.0	1181.6	1144.7	1110.0	1077.4	1046.6	1017.5	990.0	963.9	939.2	915.7	893.4
1150.0	1320.5	1276.5	1235.3	1196.7	1160.5	1126.3	1094.1	1063.7	1035.0	1007.8	981.9	957.4	934.0
1200.0	1377.9	1332.0	1289.0	1248.7	1210.9	1175.3	1141.7	1110.0	1080.0	1051.6	1024.6	999.0	974.6
1250.0	1435.3	1387.5	1342.7	1300.8	1261.4	1224.3	1189.3	1156.2	1125.0	1095.4	1067.3	1040.6	1015.2
1300.0	1492.8	1443.0	1396.5	1352.8	1311.8	1273.2	1236.9	1202.5	1170.0	1139.2	1110.0	1082.2	1055.9
1350.0	1550.2	1498.5	1450.2	1404.8	1362.3	1322.2	1284.4	1248.7	1215.0	1183.0	1152.7	1123.9	1096.5
1400.0	1607.6	1554.0	1503.9	1456.9	1412.7	1371.2	1332.0	1295.0	1260.0	1226.8	1195.4	1165.5	1137.1
1450.0	1665.0	1609.5	1557.6	1508.9	1463.2	1420.1	1379.8	1341.2	1305.0	1270.7	1238.1	1207.1	1177.7
1500.0	1722.4	1665.0	1611.3	1560.9	1513.6	1469.1	1427.1	1387.5	1350.0	1314.5	1280.8	1248.7	1218.3
1550.0	1779.8	1720.5	1665.0	1613.0	1564.1	1518.1	1474.7	1433.7	1395.0	1358.3	1323.5	1290.4	1258.9
1600.0	1837.2	1776.0	1718.7	1665.0	1614.5	1567.1	1522.3	1480.0	1440.0	1402.1	1366.2	1332.0	1299.5

umhos/cm	17	18	19	20	21	22	23	24	25	26	27	28	29	30	umhos/cm
300.0	237.9	232.3	227.0	222.0	217.2	212.6	208.1	203.9	199.8	195.9	192.1	188.5	185.0	181.6	300.0
325.0	257.7	251.7	246.0	240.5	235.3	230.3	225.5	220.9	216.4	212.2	208.1	204.2	200.4	196.8	325.0
350.0	277.5	271.0	264.9	259.0	253.4	248.0	242.8	237.9	233.1	228.5	224.1	219.9	215.8	211.9	350.0
375.0	297.3	290.4	283.8	277.5	271.5	265.7	260.2	254.8	249.7	244.9	240.1	235.6	231.3	227.0	375.0
400.0	317.1	309.8	302.7	296.0	289.6	283.4	277.5	271.8	266.4	261.2	256.2	251.3	246.7	242.2	400.0
425.0	337.0	329.1	321.6	314.5	307.7	301.1	294.8	288.8	283.0	277.5	272.2	267.0	262.1	257.3	425.0
450.0	356.8	348.5	340.6	333.0	325.8	318.8	312.2	305.8	299.7	293.8	288.2	282.7	277.5	272.5	450.0
475.0	376.6	367.8	359.5	351.5	343.9	336.5	329.5	322.8	316.3	310.1	304.2	298.4	292.9	287.6	475.0
500.0	396.4	387.2	378.4	370.0	362.0	354.3	346.9	339.9	333.0	326.5	320.2	314.2	308.3	302.7	500.0
525.0	416.2	406.6	397.3	388.5	380.1	372.0	364.2	356.8	349.6	342.8	336.2	329.9	323.8	317.9	525.0
550.0	436.1	425.9	416.2	407.0	398.2	389.7	381.6	373.8	366.3	359.1	352.2	345.6	339.2	333.0	550.0
575.0	455.9	445.3	435.2	425.5	416.2	407.4	398.9	390.8	382.9	375.4	368.2	361.3	354.6	348.1	575.0
600.0	475.7	464.7	454.1	444.0	434.3	425.1	416.2	407.8	399.6	391.8	384.2	377.0	370.0	363.3	600.0
625.0	495.5	484.0	473.0	462.5	452.4	442.8	433.6	424.7	416.2	408.1	400.2	392.7	385.4	378.4	625.0
650.0	515.4	503.4	491.9	481.0	470.5	460.5	450.9	441.7	432.9	424.4	416.3	408.4	400.8	393.5	650.0
675.0	535.2	522.7	510.9	499.5	488.6	478.2	468.3	458.7	449.5	440.7	432.3	424.1	416.3	408.7	675.0
700.0	555.0	542.1	529.8	518.0	506.7	496.0	485.6	475.7	466.2	457.1	448.3	439.8	431.7	423.8	700.0
725.0	574.8	561.5	548.7	536.5	524.8	513.7	503.0	492.7	482.8	473.4	464.3	455.5	447.1	439.0	725.0
750.0	594.6	580.8	567.6	555.0	542.9	531.4	520.3	509.7	499.5	489.7	480.3	471.2	462.5	454.1	750.0
775.0	614.5	600.2	586.5	573.5	561.0	549.1	537.7	526.7	516.1	506.0	496.3	486.9	477.9	469.2	775.0
800.0	634.3	619.5	605.5	592.0	579.1	566.8	555.0	543.7	532.8	522.4	512.3	502.6	493.3	484.4	800.0
825.0	654.1	638.9	624.4	610.5	597.2	584.5	572.3	560.7	549.4	538.7	528.3	518.3	508.8	499.5	825.0
850.0	673.9	658.3	643.3	629.0	615.3	602.2	589.7	577.7	566.1	555.0	544.3	534.1	524.2	514.6	850.0
875.0	693.7	677.6	662.2	647.5	633.4	619.9	607.0	594.6	582.7	571.3	560.3	549.8	539.6	529.8	875.0
900.0	713.6	697.0	681.1	666.0	651.5	637.7	624.4	611.6	599.4	587.6	576.3	565.5	555.0	544.9	900.0
925.0	733.4	716.3	700.1	684.5	669.6	655.4	641.7	628.6	616.0	604.0	592.4	581.2	570.4	560.0	925.0
950.0	753.2	735.7	719.0	703.0	687.7	673.1	659.1	645.6	632.7	620.3	608.4	596.9	585.8	575.2	950.0
975.0	773.0	755.1	737.9	721.5	705.8	690.8	676.4	662.6	649.3	636.6	624.4	612.6	601.3	590.3	975.0
1000.0	792.9	774.4	756.8	740.0	723.9	708.5	693.7	679.6	666.0	652.9	640.4	628.3	616.7	605.5	1000.0
1050.0	832.5	813.1	794.7	777.0	760.1	743.9	728.4	713.6	699.3	685.6	672.4	659.7	647.5	635.7	1050.0
1100.0	872.1	851.9	832.5	814.0	796.3	779.4	763.1	747.6	732.6	718.2	704.4	691.1	678.3	660.0	1100.0
1150.0	911.8	890.6	870.3	851.0	832.5	814.8	797.8	781.5	765.9	750.9	736.4	722.5	709.2	696.3	1150.0
1200.0	951.4	929.3	908.2	888.0	868.7	850.2	832.5	815.5	799.2	783.5	768.5	754.0	740.0	726.5	1200.0
1250.0	991.1	968.0	946.0	925.0	904.9	885.6	867.2	849.5	832.5	816.2	800.5	785.4	770.8	756.8	1250.0
1300.0	1030.7	1006.7	983.9	962.0	941.1	921.1	901.9	883.5	865.8	848.8	832.5	816.8	801.7	787.1	1300.0
1350.0	1070.4	1045.5	1021.7	999.0	977.3	956.5	936.6	917.4	899.1	881.5	864.5	848.2	832.5	817.4	1350.0
1400.0	1110.0	1084.2	1059.5	1036.0	1013.5	991.9	971.2	951.4	932.4	914.1	896.5	879.6	863.3	847.6	1400.0
1450.0	1149.6	1122.9	1097.4	1073.0	1049.7	1027.3	1005.9	985.4	965.7	946.8	928.6	911.0	894.2	877.9	1450.0
1500.0	1189.3	1161.6	1135.2	1110.0	1085.9	1062.8	1040.6	1019.4	999.0	979.4	960.6	942.5	925.0	908.2	1500.0
1550.0	1228.9	1200.3	1173.1	1147.0	1122.1	1098.2	1075.3	1053.4	1032.3	1012.1	992.6	973.5	955.8	938.5	1550.0
1600.0	1268.6	1239.1	1210.9	1184.0	1158.3	1133.6	1110.0	1087.3	1065.6	1044.7	1024.6	1005.3	986.7	968.7	1600.0

Table A (cont'd) –CONDUCTIVITY — TDS CONVERSION CHART March 1982

FIGURE A

Instruments Used in the Measurement of Specific Conductance



APPENDIX IX
SPECIES PROTECTED UNDER THE ONTARIO ENDANGERED SPECIES ACT

1.	Blue Racer	*Coluber constrictor foxi*
2.	Timber Rattlesnake	*Crotalus horridus horridus*
3.	Peregrine Falcon	*Falco peregrinus anatum*
4.	Bald Eagle	*Haliaeetus leucocephalus alascanus*
5.	West Virginia White Butterfly	*Pieris virginiensis*
6.	Lake Erie Water Snake	*Natrix sipedon insularum*
7.	Piping Plover	*Charadrius melodus*
8.	Eskimo Curlew	*Numenius borealis*
9.	Golden Eagle	*Aquila chrysaetos*
10.	White Pelican	*Pelecanus erythrorhynchos*
11.	Mountain Lion or Eastern Cougar	*Felis concolor couguar*
12.	Small White Lady's-Slipper	*Cypripedium candidum*
13.	Kirtland's Warbler	*Dendroica kirtlandii*
14.	Small Whorled Pogonia Orchid	*Isotria medeoloides*

APPENDIX X.

PROVINCIALLY SIGNIFICANT BIRD SPECIES

Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Double-crested Cormorant	*Phalacrocorax auritus*
Least Bittern	*Ixobrychus exilis*
Great Egret	*Casmerodius albus*
Cattle Egret	*Bubulcus ibis*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Northern Pintail	*Anas acuta*
Northern Shoveler	*Anas clypeata*
American Wigeon	*Anas americana*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ruddy Duck	*Oxyura jamaicensis*
Northern Harrier	*Circus cyaneus*
Red-shouldered Hawk	*Buteo lineatus*
Yellow Rail	*Coturnicops noveboracensis*
King Rail	*Rallus elegans*
Sandhill Crane	*Grus canadensis*
Wilson's Phalarope	*Phalaropus tricolor*
Franklin's Gull	*Larus pipixcan*
Little Gull	*Larus minutus*
Caspian Tern	*Sterna caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Black Tern	*Chlidonias niger*

Short-eared Owl	Asio flammeus
Chuck-will's-widow	Caprimulgus carolinensis
Acadian Flycatcher	Empidonax virescens
Tufted Titmouse	Parus bicolor
Sedge Wren	Cistothorus platensis
Marsh Wren	Cistothorus palustris
White-eyed Vireo	Vireo griseus
Prothonotary Warbler	Protonotaria citrea
Louisiana Waterthrush	Seiurus motacilla
Hooded Warbler	Wilsonia citrina
Lark Sparrow	Chondestes grammacus
Le Conte's Sparrow	Ammodramus leconteii
Sharp-tailed Sparrow	Ammodramus caudacutus
Lincoln's Sparrow	Melospiza lincolnii
Yellow-headed Blackbird	Xanthocephalus xanthocephalus

If a wetland provides habitat for migrating shorebirds the following species are considered significant:

Black-bellied Plover	Pluvialis squatarola
Whimbrel	Numenius phaeopus
Hudsonian Godwit	Limosa haemastica
Marbled Godwit	Limosa fedoa
Red Knot	Calidris canutus
White-rumped Sandpiper	Calidris fuscicollis
Baird's Sandpiper	Calidris bairdii
Pectoral Sandpiper	Calidris melanotos
Stilt Sandpiper	Calidris himantopus
Short-billed Dowitcher	Limnodromus griseus

APPENDIX XI.

PROVINCIALLY SIGNIFICANT MAMMAL SPECIES

Species	
Eastern Mole	*Scalopus aquaticus*
Southern Bog Lemming	*Synaptomys cooperi*
Pygmy Shrew	*Microsorex hoyi*
Least Shrew	*Cryptotis parva*
Virginia Opossum	*Didelphis virginiana*
River Otter	*Lutra canadensis*

APPENDIX XII.

PROVINCIALLY SIGNIFICANT AMPHIBIAN AND REPTILE SPECIES

Species	
Spotted Turtle	Clemmys guttata
Wood Turtle	Clemmys insculpta
Eastern Spiny Softshell Turtle	Trionyx spiniferus spiniferus
Box Turtle	Terrapene carolina
Queen Snake	Natrix septemvittata
Butler's Garter Snake	Thamnophis butteri
Eastern Hognose Snake	Heterodon platyrhinos
Eastern Fox Snake	Elaphe vulpina
Black Rat Snake	Elaphe obsoleta obsoleta
Eastern Massasauga Rattlesnake	Sistrurus catenatus catenatus
Small-mouthed Salamander	Ambystoma texanum
Jefferson Salamander	Ambystoma jeffersonianum
Silvery Salamander	Ambystoma platineum
Tremblay's Salamander	Ambystoma tremblayi
Tiger Salamander	Ambystoma tigrinum
Blue-spotted Salamander	Ambystoma laterale
Spring Salamander	Gyrinophilus porphyriticus
Dusky Salamander	Desmognathus fuscus
Four-toed Salamander	Hemidactylum scutatum
Fowler's Toad	Bufo woodhousei fowleri
Blanchard's Cricket Frog	Acris crepitans blanchardi

APPENDIX XIII.

PROVINCIALLY SIGNIFICANT FISH SPECIES

Species		status
central stoneroller	- Campostoma anomalum	*
redside dace	- Clinostomus elongatus	*
spotted gar	- Lepisosteus oculatus	R
silver chub	- Hybopsis storeriana	*
brindled madtom	- Noturus miurus	*
river redhorse	- Moxostoma carinatum	R
spotted sucker	- Minytrema melanops	R
silver shiner	- Notropis photogenis	R
pugnose minnow	- Notropis emiliae	*
pugnose shiner	- Notropis anogenus	*
gravel chub	- Hybopsis x-punctata	*
blackstripe	- Fundulus notatus	*

R = classified as rare by COSEWIC
* = presently under review by COSEWIC

Rare Species - any indigenous species of fauna or flora that, because of its biological characteristics, or because it occurs at the fringe of its range or for some other reason, exists in low numbers or in very restricted areas in Canada but is not a threatened species.