WETLAND EVALUATION GUIDE

SUSTAINING wetlands

ISSUES PAPER, No. 1992 - 1

PUBLISHED IN PARTNERSHIP WITH:

WILDLIFE HABITAT CANADA

CANADA'S GREEN PLAN
LE PLAN VERT DU CANADA

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

North American Wetlands Conservation Council (Canada)

Printed March 1992
Ottawa, Ontario

The *Sustaining Wetlands Issues Paper Series* is published by the Secretariat to the North American Wetlands Conservation Council (Canada). The Series is devoted to the publication of reports concerning wetland management, policy, and science issues of national importance in Canada. The objective of this Series is to make Canadians more aware of the importance of the wise use and conservation of wetland ecosystems and their natural resource value.

This *Wetland Evaluation Guide* was funded through the partnership of:
Canadian Wildlife Service, Environment Canada
Wildlife Habitat Canada

Production and distribution was coordinated by:
North American Wetlands Conservation Council (Canada)
Canadian Wetlands Conservation Task Force

Copies of this report are available free of charge from:
Secretariat
North American Wetlands Conservation Council (Canada)
Suite 200, 1750 Courtwood Crescent
Ottawa, Ontario K2C 2B5

Cover: Wetlands in Algonquin Provincial Park, Ontario. Photo: K. Cox

Également disponible en français sous le titre: *Guide d'évaluation des terres humides.*

WETLAND EVALUATION GUIDE

FINAL REPORT OF THE
WETLANDS ARE NOT WASTELANDS
PROJECT

by

W.K. Bond

K.W. Cox

T. Heberlein

E.W. Manning

D.R. Witty

and

D.A. Young

SUSTAINING wetlands

Issues Paper, No. 1992 - 1

North American Wetlands Conservation Council (Canada)

Table of Contents

Foreword

Wetlands are a commonly misunderstood resource. Terms such as swamp or wasteland are frequently used — belying a common failure to understand and value wetland environments. Yet wetlands are among the richest of environments, often providing a wide range of benefits to society. Simply put, an environment without wetlands is incomplete and may be unable to support the functions upon which we depend for livelihood, lifestyle and life support.

This *Wetland Evaluation Guide* represents the completion of a joint project between Environment Canada and Wildlife Habitat Canada to fill the need for an objective and comprehensive means to address wetland development concerns. The Guide is designed to help those who must deal with the conversion, modification or conservation of wetlands to identify all of the functions and values involved, and to aid them in assessing the trade-offs that may be necessary. If properly applied, this Guide will result in a much greater understanding of the role of wetlands, and the effective integration of that understanding into the planning process.

While the focus of this project and of the Guide has been on wetlands, this approach and methodology can ultimately have much broader application. Wetlands were chosen as the initial focus because they encompass such a broad range of environmental factors and benefits derived from them. The range of functions and values identified can also be found in agricultural, forested, aquatic, or other environments.

This Guide is intended to be of use to anyone who is involved in a decision concerning the alteration, removal, preservation, reconstruction, or use of wetland environments. The Guide can be used as a point of reference for planners, developers, environmental or conservation groups, administrators, educators, landowners, and politicians. It is hoped that this Guide will lead to greater understanding of the benefits associated with wetlands to society and to landowners and will foster informed and rational decisions concerning the use and management of wetland environments.

Comments on this Guide are welcomed and may be provided to the Secretariat to the North American Wetlands Conservation Council (Canada) in Ottawa.

David Brackett
Director General
Canadian Wildlife Service
Environment Canada

David J. Neave
Executive Director
Wildlife Habitat Canada

Acknowledgements and Background

A great deal of time and effort has gone into the conceptualization, research, pilot studies, writing, field testing and publication of this Wetland Evaluation Guide. Many people contributed throughout the five years it was being developed. Thanks are offered to all who were directly involved, commented on, or just gave support during its creation.

The following individuals and organizations contributed directly to its development.

"Wetlands Are Not Wastelands" Project: National Steering Committee

Co-Chairs: Kenneth W. Cox, Chairman, Canadian Wetlands Conservation Task Force 1991-1992, Wildlife Habitat Canada 1985-1990, Ottawa

Edward W. Manning, Sustainable Development Branch, Environment Canada, Ottawa

Project Manager: Wayne K. Bond, Sustainable Development Branch, Environment Canada, Ottawa

Members: Gerry O. Lee, Canadian Wildlife Service, Environment Canada, Ottawa

Fern Filion, Canadian Wildlife Service, Environment Canada, Ottawa

Authors: Wetland Evaluation Guide (in alphabetical order)

Wayne K. Bond, Sustainable Development Branch, Environment Canada, Ottawa

Kenneth W. Cox, Chairman, Canadian Wetlands Conservation Task Force, Ottawa

Thomas Heberlein, University of Wisconsin, Madison

Edward W. Manning, Sustainable Development Branch, Environment Canada, Ottawa

David R. Witty, Hilderman, Witty, Crosby, Hanna and Associates, Winnipeg

Don A. Young, Environmental Management Associates, Calgary and Regina

Principal Advisors: Wetland Evaluation Guide

Michal Bardecki, Ryerson Polytechnical Institute

Nigel Richardson, N.H. Richardson Consulting

Peter Stokoe, Dalhousie University

Clayton Rubec, Secretariat North American Wetlands Conservation Council (Canada)

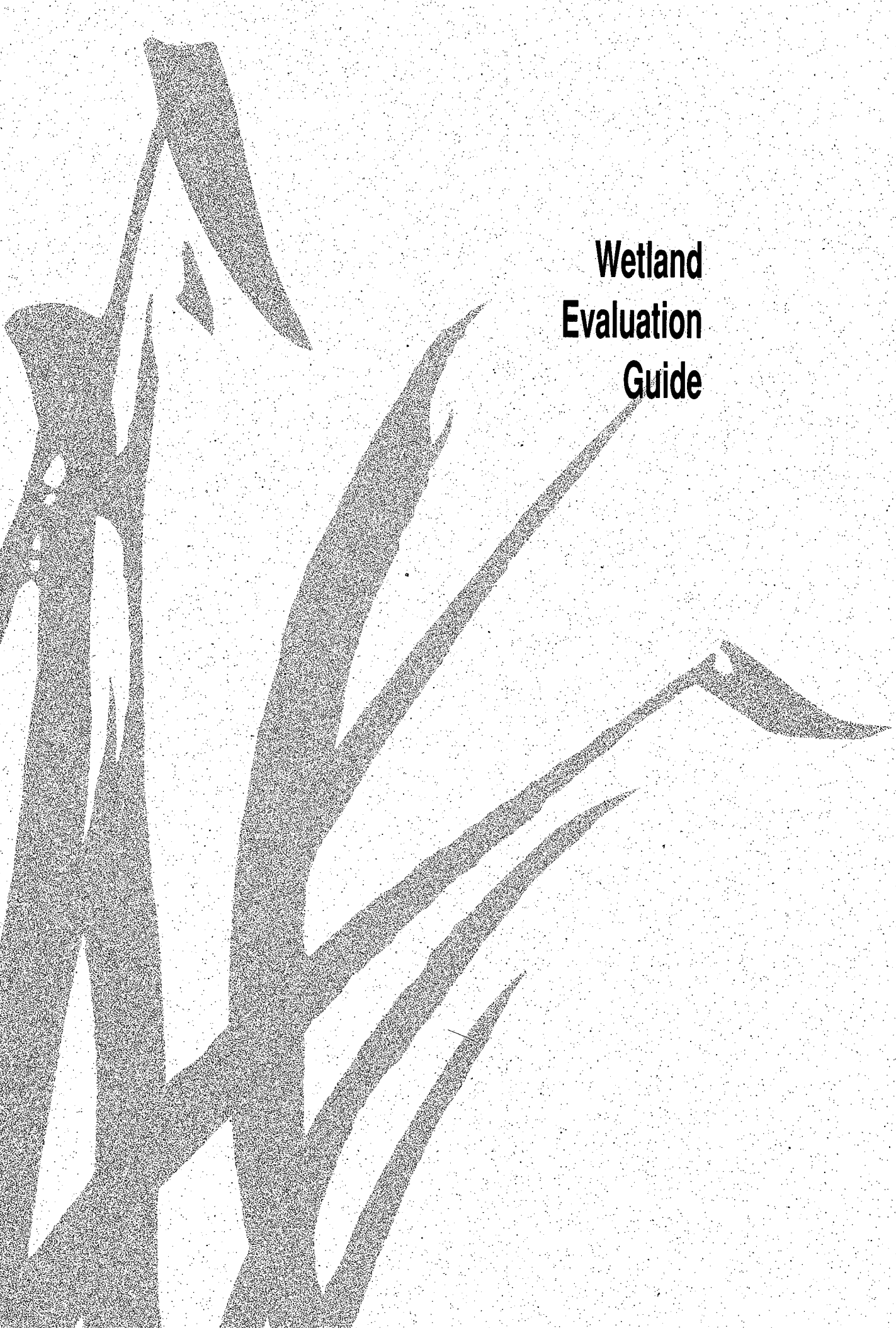
Study Process

The project has been undertaken in a number of distinct phases, namely:

1. a preliminary workshop on alternative evaluation methods,
2. a literature review of alternative evaluation methods,
3. four pilot studies to test proposed evaluation methods in different regions of Canada,
4. a workshop of specialists to review the pilot study results and propose an outline for the *Wetland Evaluation Guide*, and
5. the drafting, review, revision and testing of the *Wetland Evaluation Guide* itself.

Each of these phases is briefly described in Appendix A. Workshop participants, authors of studies, and steering committee members for individual pilot studies are also gratefully acknowledged in Appendix A.

As in any multi-year project with many phases, there have been numerous other people who contributed in a variety of ways. Appreciation is extended to all those who participated in the pilot studies as field researchers, interviewers, computer analysts, cartographers, word processors or providers of information. To others who assisted the project in many ways, the authors extend their thanks.



Wetland Evaluation Guide

1.0 Preface

Too often, wetlands have been considered as wasteland, unworthy of special attention. As a result, wetlands have frequently been altered or lost simply because their value was not understood and factored into the decision process. Yet, growing evidence clearly demonstrates the very important role — wildlife production, flood protection, nature study, aquifer recharge, toxic buffering, and recreation — that wetlands play in our total environment.

Environment Canada and Wildlife Habitat Canada jointly undertook this project to examine methods for evaluating wetlands to facilitate the identification and the conservation of valuable areas. Under the auspices of the "Wetlands Are Not Wastelands" Project, several promising approaches to valuing environments were identified. Four pilot studies were then done in the Atlantic, Central, Prairie and Pacific Coast regions of Canada. These studies examined the utility and applicability of methods of wetland evaluation and formed the basis for this Evaluation Guide.

Simply put, an environment without wetlands is incomplete and a potential threat to our well-being. Clearly, our past pattern of treatment of wetlands cannot continue: drainage, filling, dyking, and conversion of wetlands must be re-examined as part of overall environmental stewardship. As the steward of 24% of the world's remaining wetlands, Canadians have no other choice.

This Evaluation Guide presents methods and procedures which identify wetland values and help to put the full range of wetland values centrally into the planning decision process. By examining this guide and applying its evaluation methods, politicians, planners, administrators, landowners, developers, non-government organizations, and individuals will be better able to consider the implications of land use decisions upon this important environmental resource.

A Simple Three-Stage Approach

The core of this Guide is a three-stage evaluation approach which provides steps to be followed to identify the benefits from a wetland which may be present and to establish their value to society and to compare their value to the value of proposed alternatives. This approach takes the evaluator through three stages or steps in the evaluation process: the first is a general evaluation based on readily available information; the second requires a detailed inventory of wetland functions and benefits; the last is a specialized analysis based on specific wetland and project values which may have to be established by the evaluator.

Many evaluations will only require the first or second stage. This guide gives decision makers the opportunity to apply evaluation techniques that have proven their worth, to identify the particular level of detail required for a specific wetland, and the type of information required to render an informed decision.

As one moves from the first stage to the second stage to the third stage, the focus changes from known documented and recognized values to more specific values which must be researched in detail for the particular wetland and project proposal under review. In the third stage of evaluation, the expertise of biophysical or socio-economic specialists will likely be required to give comprehensive documentation and consideration of the competing values.

Once the evaluator arrives at a well considered evaluation and incorporates these findings into a recommendation, decision makers are able to determine the most appropriate use for the existing wetland, based on the full range of functions and values.

The evaluator moves from Stage One to Stage Two and finally to Stage Three only if the preceding stage does not clearly identify the most appropriate use.

Why Wetlands are Important

Wetlands can have a wide range of functions, which support provision of products, services, life support, and experiences locally and more broadly. Some wetlands are of international, national, provincial or regional significance according to their biological, hydrological, social/cultural and/or economic production functions. Other wetlands may not be as well known or may have few obvious functions. All have some value which needs to be recognized in any evaluation process.

The value of wetland functions may or may not be quantifiable. For example, it may be possible to describe the number of shorebird and waterfowl produced on and/or that frequent a wetland. It may also be possible to measure the economic benefits associated with these birds, whether they accrue locally (for example through hunting or viewing) or far away at the other end of a migration flyway. Both are important, but may require different means of measurement and evaluation. Wetlands are also key elements of the life-support system, having ecological benefits which present different challenges to evaluators.

Value to society comes from use value, for either consumptive uses (e.g. hunting, rice harvest) or non-consumptive uses (e.g.. viewing, water purification). There are also more intangible functions or values to wetlands such as existence value (just knowing the wetland and its associated assets exist even without directly experiencing them), and option value (future opportunity for use or to provide as yet unappreciated values). This latter category includes bequest value (leaving an intact environment for future generations). These values provide more difficult challenges in establishing and quantifying value. Yet these are important values which should not be ignored when making decisions involving wetlands.

As wetlands continue to be subjected to degradation and the wetland resource is reduced, interest in effectively establishing the value of wetlands continues to grow. Which wetlands, and which attributes of wetlands are critical to protect? Which are not, and can be altered or redeployed to other uses? This Guide focuses on identifying the value of benefits deriving from individual wetlands or wetland complexes, identifying their sensitivity to proposed changes, and evaluating the alternatives, given knowledge of these values.

Photo: Canadian Wildlife Service

Wetland conservation benefits many wildlife species such as Canada Goose.

Economic Evaluation and Sustainable Development

Land use decisions affecting wetlands have frequently been based primarily on the direct benefits predicted for the proposed development. While economic

worth is important, other costs or impacts of such activity are often not properly identified. This is particularly important where the same or similar benefits could be obtained on other sites with less impact.

The Brundtland Commission's "Our Common Future" report promoted the concept of sustainable development. This means development which builds on the strengths of the environment and does not waste environmental resources. This approach also implies strengthened planning procedures to anticipate and prevent negative environmental impacts. Wetlands are natural systems worthy of careful evaluation for their biological, hydrological and socio-cultural values. Application of the concept of sustainable development to wetlands will require careful consideration of the full range of values derived from wetland environments in an attempt to make optimal long-term use of environmental resources.

In the end, decision makers will continue to make hard choices affecting wetland retention, conversion to some other use, or a combination of the two. Better informed analyses will assist in that endeavor. This Wetland Evaluation Guide is designed to facilitate such analyses.

2.0 Introduction

2.1 Importance of Wetlands

Wetlands occupy an important transitional position between land and water and may have fresh, brackish or saline waters. They may be permanent, seasonal or temporary.

In recognition of the variety of wetlands across Canada, the Canadian Wetland Classification System recognizes five wetland classes: bog, fen, swamp, marsh and shallow open water (see Wetland Classes, Section 3). These categories represent the geographical diversity of Canada with various wetland classes associated with certain regions (i.e. primarily marsh and shallow open water in prairie regions, and bog and fen in northern regions).

While wetlands were once viewed primarily in terms of development, for example, as agricultural lands, their ecological value has now been more clearly identified. Depending on wetland location, class, and function, such values may include sustenance of enormous numbers of waterfowl, sources of fish production, storage and slow release of large quantities of water, erosion protection, places of beauty and recreational enjoyment.

With the increasing competition for land, particularly in urban areas, changes to agricultural production techniques and increased demand for hydro-electric power, wetlands have continued to be impacted through dyking, filling, drainage, flooding, and other forms of conversion. Such use has caused the number and extent of wetlands to decrease substantially. This Guide provides a means of objectively measuring wetland values to facilitate well-informed decisions concerning wetlands.

Wetland is defined as "land that has the water table at, near, or above the land's surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to the wet environment."

National Wetlands Working Group (1988).

2.2 Evaluation of Wetlands

In the past, wetlands have frequently been viewed as a detriment to economic development, an impediment to progress, and a cost to efficient land use, or, as a source of land for development. With comprehensive socio-economic evaluation methods, however, wetlands have come to be recognized as having importance in their own right. These values are based upon recognition of the critical

role wetlands play in the ecosystem, as well as their contribution to, for example, recreational activity and land value through erosion protection and water supply. Conversion or alteration of wetlands therefore comes at some cost.

While some wetlands are recognized as significant because of their uniqueness, others are also gaining importance due to cumulative losses of typical wetlands which reduce the overall number of wetlands approaching threshold limits for specific functions in some regions. Also, the more we study wetlands, the more we learn of their role in the provision of products, services, experiences and basic life-support systems. Any evaluation of wetlands must consider uniqueness and relationship to all wetland functions.

There are two serious obstacles to wetland decision making and associated evaluation. First, there still persists a serious lack of knowledge and experience in expressing wetland functions and their benefits to society in meaningful terms. A second major impediment to wetland evaluation relates to the fact that the majority of wetland benefits accrue to the public in general, and not exclusively to a particular landowner. As decisions regarding wetlands in private ownership are usually based on individual benefit, the costs to society are seldom built into the evaluation.

Wetlands are complex environments. They require careful, rigorous examination to fully document their values. The values are often subtle or cumulative in their significance. Evaluation of such complex environments must change so that greater recognition is given to all values.

2.3 Distribution of Wetlands

Canada's wetlands are distributed across all regions, and cover approximately 14% of the country (1.27 million km^2). These wetlands in turn constitute approximately one quarter of the world's remaining supply of wetlands. The largest concentrations occur in northern Ontario, mid to northern Manitoba, northern Alberta and in the Northwest Territories. The largest conflicts between wetland conservation and wetland utilization, however, are concentrated in southern Canada where population, agriculture, and development activities are greatest. Agricultural expansion has been and continues to be the major cause of wetland conservation in Canada. For instance, in southern Ontario, over 85% of wetland loss is attributed to drainage. Regional studies estimate that 65% of Atlantic coastal marshes, 68% of southern Ontario wetlands, up to 70% of prairie wetlands, and 80% of the Fraser River Delta, British Columbia, have been converted to other land uses (as of 1985 relative to the time preceding European settlement). Furthermore, 80% to 98% of the wetlands

Photo: K. Cox

Waterfowl hunting is one of many recreational opportunities offered by wetlands across Canada.

Environment Canada has published an excellent summary of wetland status and losses to conversion.

See: *Wetlands in Canada: A Valuable Resource*, Environment Canada, 1986.

surrounding many major urban centres (Montreal, Toronto, Windsor, Winnipeg, Regina, Saskatoon and Edmonton) have been converted to accommodate agriculture, harbour development and urban expansion. Wetlands continue to disappear at the rate of about one-half hectare per minute.

2.4 Purpose of this Guide

The purpose of this Guide is to facilitate an objective and comprehensive assessment of competing proposals for the use of areas including wetland environments. What are the values associated with the wetland in its current state? What values will be lost or gained if the proposed development occurs? How can these be evaluated to support a decision on the use of the wetland?

2.5 Evaluation Steps

The Guide utilizes a three-stage approach for wetland and development evaluation (Figure 2.1). The methods combine ecosystem and economic evaluation techniques.

Stage One evaluates wetland resources and proposed development as a "General Analysis" step. In this stage, data/information is easily retrievable and well documented, the appropriate decision (project approval, rejection or mitigation/relocation) is easily confirmed, and/or either the wetland or the project is readily identified as being the more beneficial. If not, the evaluator moves to Stage Two.

Stage Two is a more "Detailed Analysis". It evaluates wetland resources using a multiple value matrix. Application of Stage Two occurs when Stage One cannot provide suitable direction or data is insufficient at the Stage One level. Stage Two must draw upon additional, usually existing, data sources.

Stage Three or the "Specialized Analysis" stage is applied in the evaluation process when Stage Two fails to address all issues and/or the application of the multiple value evaluation process is incomplete or inconclusive. Unlike the previous two stages, Stage Three relies upon new data collection, utilizes detailed economic methods for full evaluation and is usually undertaken by professional specialists. It is typically reserved for major projects or classes of projects.

2.6 Use of Guide

The Guide sets out a structured review, evaluation and recommendation process. It serves as a common starting point for different groups, including the proponent, planners and conservation groups to systematically determine the values and issues at stake and start a dialogue on a common basis. This process moves from an initial approach (Stage One), to a more detailed evaluation (Stage Two), then to a more specialized application (Stage Three). It is expected that land use planners and related disciplines, administrators and project proponents will be able to apply the Stage One analysis. Stage Two will likely be applied by land use planners and related disciplines, with special training in multiple resource analysis and support from specialized disciplines (biology, sociology, economics, hydrology) as required. Stage Three, on the other hand, will very likely require coordination and application by a resource economist with assistance from specialists in a variety of fields because of the complex nature of the task and additional data collection. All stages provide information on the range of functions and related benefits which may be found in particular wetland environments.

This Guide assists in placing proper evaluation on wetlands. It is based upon a three-stage approach:

- **General Analysis**
- **Detailed Analysis**
- **Specialized Analysis.**

Who should use this Guide?

- **planners and decision makers at local and regional levels**
- **natural resource managers and public agencies at a provincial or national level**
- **developers and conservation groups**
- **administrators and politicians**
- **educators**
- **anyone interested in effective planning of wetland environments**

The Guide will be useful in a variety of situations. For example, it can assist in evaluating the desirability of proceeding with agricultural, recreational, industrial or residential developments in estuarine/delta wetlands. It will also help to identify the appropriateness of draining, protecting or enhancing/restoring prairie potholes. It can also be used to analyze the implications of, and suitable response to wetland filling in urban areas of the country.

While many rural/agricultural drainage projects continue to occur without systematic scrutiny, due to their small size or due to exclusion from formal review procedures, the Guide can serve as an illustration of the factors that need to be considered. The Guide can be at least informally applied to small projects as a point of reference, or applied comprehensively as part of an assessment of the cumulative effects of widespread wetland drainage.

Wetlands are complex environments. They require systematic evaluation.

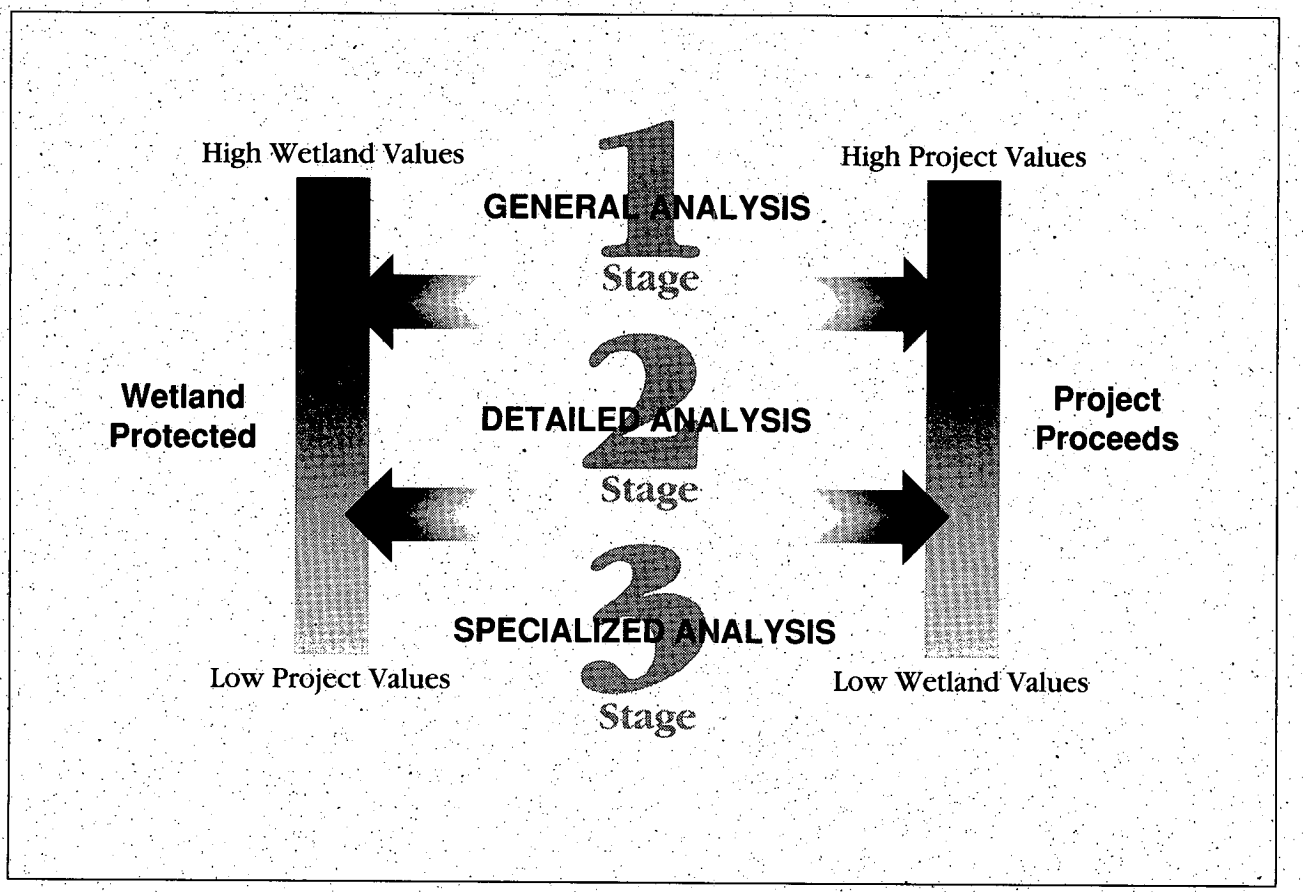


Figure 2.1 The staged approach used in this Guide.

3.0 Wetland Classes

3.1 Introduction

Despite continued detrimental impact to wetlands, Canada is blessed with a variety and abundance of wetlands - over 127 million hectares of wetland comprising an estimated 24% of the total world wetland base. Each wetland class displays unique characteristics which sets it apart biologically and hydrologically.

3.2 Classes of Wetlands

There are five wetland classes in Canada (National Wetlands Working Group 1987). These are bog, fen, swamp, marsh and shallow open water. Their development is influenced by several variables (hydrology, fauna, vegetation, soil, local climate, landscape setting and existence of permafrost).

While ecological classification is useful to conceptualize wetlands, actual field observations frequently reveal wetlands that combine several complex units. For instance, marshes are often associated with shallow open waters. Therefore, any wetland mapping must be cognizant of such complex situations.

The five wetland classes are discussed in the following sections. For a more detailed review of wetland classes, please see *Wetlands of Canada* (1988).

Bog

Bogs are peat covered wetlands in which the vegetation shows the effects of a high water table and a general lack of nutrients. The surface waters of bogs are strongly acidic. They exhibit cushion-forming sphagnum mosses and heath shrub vegetation both with and without trees. Bogs are subject to increasing interest for peatland harvesting and forestry drainage in some areas of Canada.

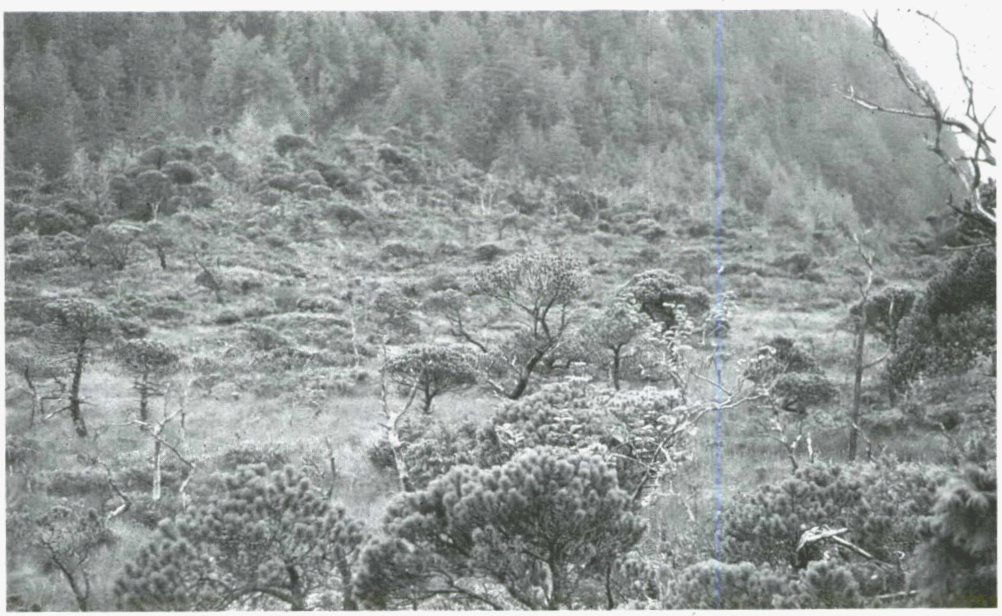


Photo: E. Oswald

Slope bog, Queen Charlotte Islands, British Columbia.

Fen

Fens are peatlands characterized by a high water table, with slow internal drainage by seepage down low gradients. They may exhibit low to moderate nutrient content and may contain shrubs, trees or neither. Like bogs, most fens occur in more northern areas generally away from agricultural or urban development impact.

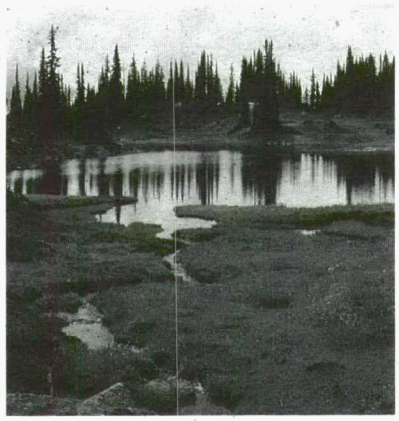


Photo: C. Rubec

Boreal fen in northwestern Manitoba.

Swamp

Swamps are wetlands where standing or gently moving water occurs seasonally or persists for long periods, leaving the subsurface continuously waterlogged. The water table may seasonally drop below the rooting zone of vegetation, creating aerated conditions at the surface. Swamps are nutrient-rich, productive sites. Vegetation may consist of dense coniferous or deciduous forest, or tall shrub thickets. Swamps are most common in southern temperate areas of Canada.

Impacts usually occur as a result of drainage for agricultural or urban development purposes or as a result of altered water level fluctuations and forestry development.

There are five wetland classes:

- **bog**
- **fen**
- **swamp**
- **marsh**
- **shallow open water**

See "Wetlands of Canada" (National Wetlands Working Group 1988) for details. Appendix E lists other selected references.

Photo: C. Rubec

Hardwood swamp at Backus Woods near London, Ontario.

Marsh

Marshes are wetlands that are periodically or permanently inundated by standing or slowly moving water and hence are rich in nutrients. Marshes are mainly wet, mineral soil areas. They are subject to a gravitational water table, but water remains within the rooting zone of plants for most of the growing season. There is a relatively high oxygen saturation. Marshes are characterized by an emergent vegetation of reeds, rushes, cattails and sedges.

The surface water levels of marshes may fluctuate seasonally (or even daily) with declining levels exposing drawdown zones of matted vegetation, mud or salt flats.

Impacts are usually caused by agriculture, dyking, filling for urban development, or impoundment development. They are common along major temperate lakes and in tidal coastal areas as well as in association with prairie ponds.

Photo: C. Rubec

Salt marshes on Grosse Île, Îles de la Madeleine, Quebec.

Shallow Open Water

Shallow open waters include potholes, sloughs or ponds as well as waters along river, coast and lakeshore areas. They are usually relatively small bodies of standing or flowing water commonly representing a transitional stage between lakes and marshes. The surface waters appear open, generally free of emergent vegetation. The depth of water is usually less than two metres at mid-summer levels.

Impact to shallow open waters comes generally from drainage for agricultural or urban development purposes as well as harbour, recreational and hydro-electric facilities development.

Photo: C. Rubec

Shallow water habitats in Nova Scotia are often rich in flora.

3.3 Distribution of Classes

Wetland classes tend to be regionalized because climate plays a dominant role in their formation. Therefore, wetland regionalization in Canada has occurred along a north-south temperature and an east-west precipitation gradient. Twenty wetland regions have been identified in Canada (National Wetlands Working Group 1986). Appendix B describes these regions.

Wetland Region Types

A review of wetland regions, current and potential activities and the impact of conversions is examined in Figure 3.1 entitled "Wetland Conversion Matrix" on pages 12-13. It demonstrates the likely continued wetland impact in wetland regions and the potential for accelerated wetland impact in others, unless new methods of wetland evaluation and protection are put in place. Significant pressure by a variety of land use activities upon the Boreal, Temperate and Prairie wetland regions is illustrated. It also suggests that many wetland forms in these regions are under pressure of conversion. As well, future potential land use activity impact will likely continue to exert conversion pressure upon wetlands (Figure 3.1). A map derived from national analysis of land use dynamics indicates those areas of relative overall pressure on wetlands in Canada (Figure 3.2).

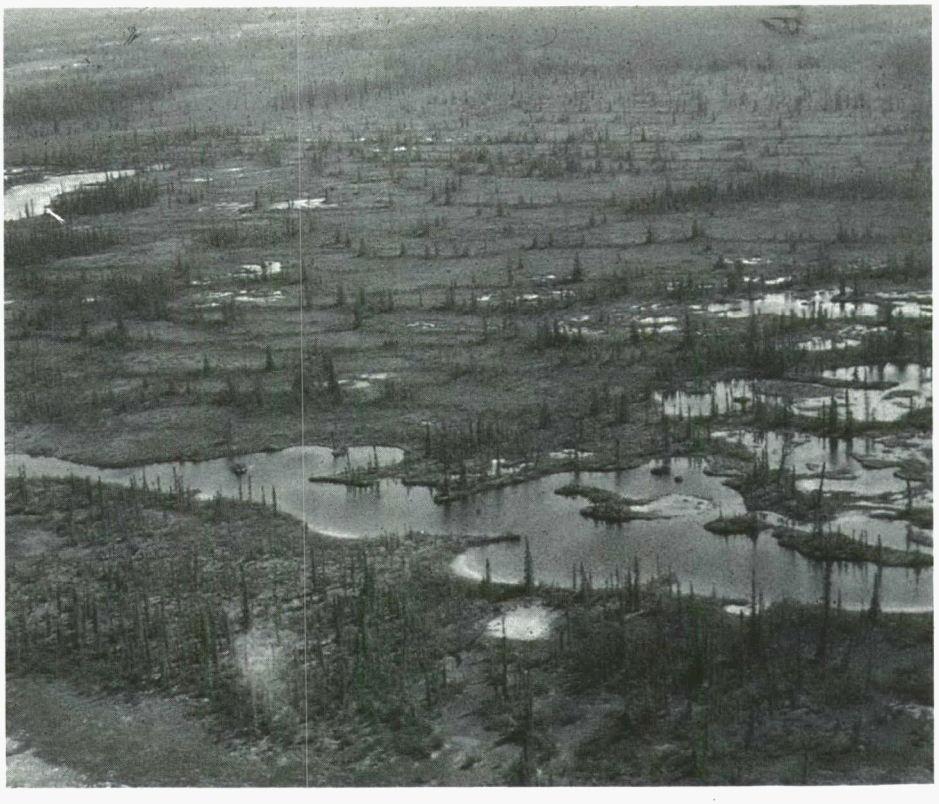


Photo: D. Wells

Peatlands dominate the landscape in much of Labrador.

Figure 3.1 Wetland Conversion Matrix

Type of primary conversion by frequency of occurrence and land use type: H = High, M = Moderate, L = Low.

WETLAND REGION	DRAINAGE						DYKING					
	Current			Potential			Current			Potential		
	H	M	L	H	M	L	H	M	L	H	M	L
High Arctic	-	-	-	-	-	-	-	-	-	-	-	-
Mid Arctic	-	-	-	-	-	-	-	-	-	-	-	-
Low Arctic	-	-	-	-	-	-	-	-	-	-	-	-
High Subarctic	-	-	-	-	-	-	-	-	-	-	-	-
Low Subarctic	-	-	-	-	-	E	-	-	-	-	-	-
Atlantic Subarctic	-	E/U/A	-	-	A/U/E	-	-	-	-	-	-	-
High Boreal	-	A	-	-	A	-	-	-	-	-	-	-
Mid Boreal	-	A/U	-	A	U	-	-	-	U/A/R	-	R	U/A
Low Boreal	-	A/U	-	-	A/U	-	-	-	-	-	-	-
Atlantic Boreal	-	A/U/E/R	-	-	A/U/E/R	-	A	U/E	R	A	R/U/E	-
Eastern Temperate	A/U	R	-	A/U/R	-	-	-	U/A	R	R	U/A	-
Pacific Temperate	A/U	R	-	A/U/R	-	-	A/U	-	R	A/U/R	-	-
Prairie Continental	A	U	R	A	U/R	-	-	-	R	-	-	R
Intermountain Continental	-	-	A/U	-	U	A	-	A/U	R	U/R	A	-
Coastal Mountain	-	-	-	-	-	-	-	-	-	-	-	-
Interior Mountain	-	-	-	-	-	-	-	-	-	-	-	-
Rocky Mountain	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Mountain	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic Oceanic	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Oceanic	-	-	-	-	-	-	-	-	-	-	-	-
Primary Affected Wetland Class(es)	**Marsh, Bog, Swamp**						**Marsh**					

Land Use Types: A = Agriculture E = Extraction HD = Hydro-electric Dams R = Recreational U = Urban

FILLING						HYDROLOGIC FLUCTUATION						DREDGING/FILLING						OVERALL LAND USE IMPACT			
Current			Potential			Current			Potential			Current			Potential						
H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	-	E	-	-	-	-	
-	-	-	-	-	-	-	-	HD	-	HD	-	-	-	E	-	-	E	-	-	HD/E	
-	-	-	-	-	E	-	-	HD	-	HD	-	-	-	E	-	E	-	-	-	HD/E	
A/U	-	-	-	A/U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	U	-	-	U	-	HD	-	HD	-	-	-	-	-	-	-	-	-	A/HD	U	
-	U	-	-	U	-	-	HD	-	-	HD	-	-	-	R	-	R	-	A	A/R	HD/R	
-	U	-	-	U	-	-	-	HD	-	HD	-	-	-	R	-	R	-	-	A/U	/HD	-
-	U	-	-	U	-	-	-	HD	-	-	HD	-	-	R	-	R	-	A	U/R/E		-
U	-	-	U	-	-	-	-	-	-	-	-	-	-	R	R	-	-	A/U	-	-	
U	-	R	U	R	-	-	-	-	-	-	-	-	-	R	R	-	-	A/U/R	-	-	
U	-	R	U	R	-	-	-	HD	-	-	HD	-	-	-	-	-	-	A	U/R	-	
-	U	-	U	R	-	-	-	HD	-	-	HD	-	-	-	-	R	-	U	A/R	-	
-	-	E	-	-	E	-	-	HD	-	-	HD	-	-	-	-	-	-	-	-	-	
-	-	E	-	-	E	-	-	HD	-	-	HD	-	-	-	-	-	-	-	-	-	
-	-	E	-	-	E	-	-	HD	-	-	HD	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	U	-	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	U	-	-	U	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	
Marsh, Shallow Open Water						Marsh, Bog, Swamp Fen						Marsh, Swamp									

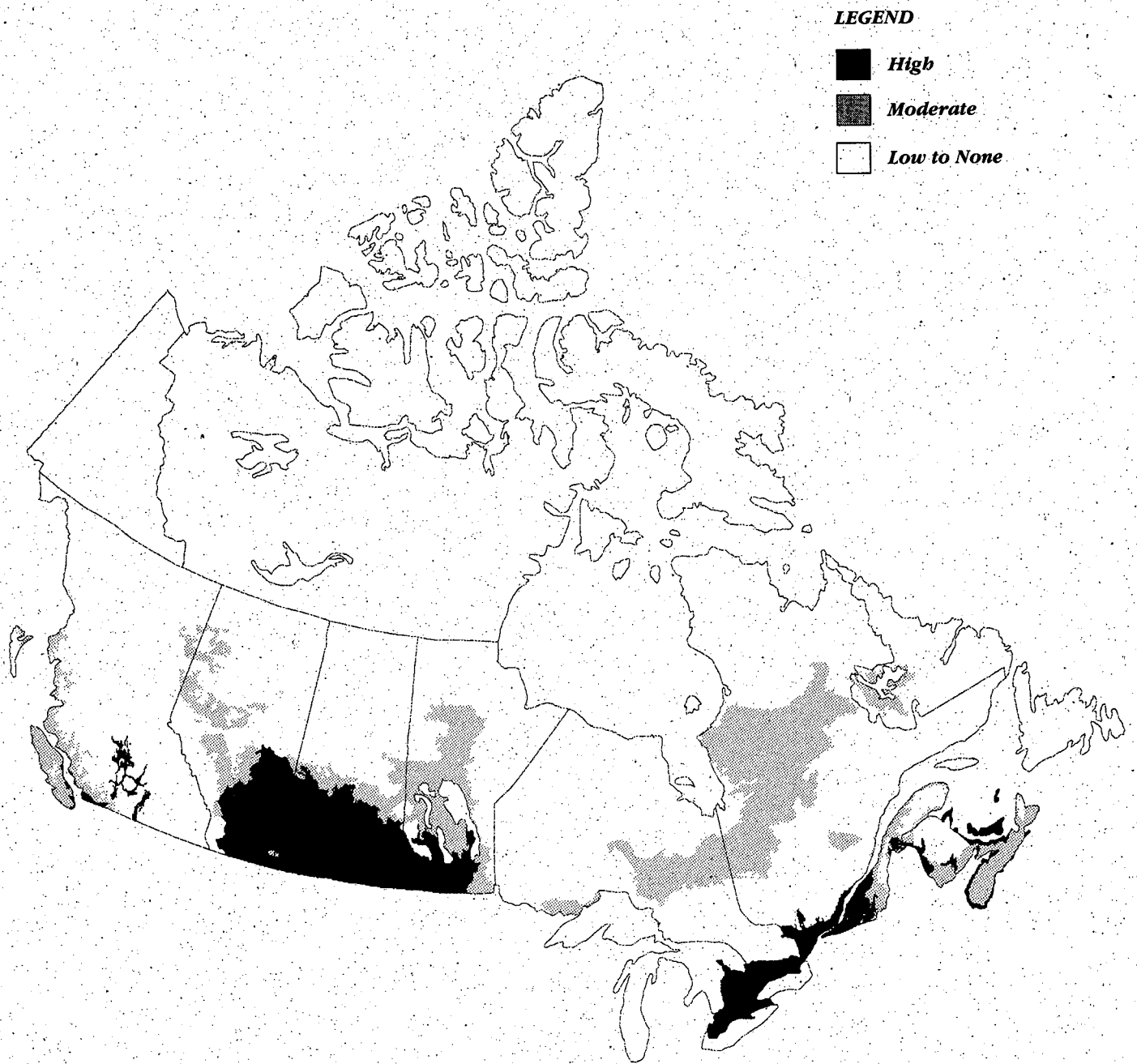


Figure 3.2 Map showing areas of relative land use pressures on wetlands in Canada.

Source: A. Turner, State of Environment Reporting Service, Environment Canada, (pers. comm.)

4.0 Wetland Functions

4.1 Introduction

Wetland functions are defined as the capabilities of wetland environments to provide goods and services including basic life-support systems. Such functions may directly or indirectly provide benefits to society. A given wetland, based on its physical and biological characteristics, can, for example, support water storage, habitat for many species, scenic views, fish habitat, toxic buffering and flood control. Based on these functions, many benefits can be derived from the wetland: e.g. clean drinking water, a place to swim, take photos, hunt ducks, reduce flood damage downstream, reduce drought risk on adjacent fields, commercial trapping of furbearers, or harvest of wild rice. Value is derived by society from the continued supply of all of these benefits. Alteration of the wetland may remove or interrupt the ability of the wetland to continue to support the functions on which these benefits depend.

This section examines wetland functions under three headings. These are: (1) life support, (2) social/cultural, and (3) production functions (Figure 4.1).

4.2 Functions as Values

Wetland functions provide many benefits to society. These benefits do have value; food, risk reduction, jobs, lifestyle, life support for humans and other species.

Wetland functions may or may not provide benefits that are readily measurable. Many benefits deriving from a wetland may have no measurable immediate value to society - the wetland may be physically remote or the function may not contribute to the sustenance of a life form or product that clearly has a market value to society. Generally, however, most wetlands contribute directly or indirectly to society's well-being and, hence, have some demonstrable value.

Wetlands have very different values which vary in type and magnitude depending upon their location, effect upon society or ecological processes and their relationship to other wetlands.

Some wetland functions, and the benefits based from them are critical to the ongoing well-being of society. Particular benefits may be sensitive to ecological limits or thresholds which cannot be exceeded. Any wetland evaluation should reflect such issues.

4.3 Life-support Functions

Regulation and Absorption

Regulation functions relate to the capacity of wetlands to regulate and maintain essential ecological processes and life-support systems. Several of these functions are described below.

Wetland hydrology is critical to the development and maintenance of wetlands and all the other functions associated with it. Conversion or change to the hydrological functions can result in associated change to the other wetland functions, reducing or eliminating the ability to absorb waste, or buffer other changes.

Wetlands play an important role in the management of water flows within their drainage basins, often effecting flood peaks and storm flows, enhancing water quality, and buffering shorelines against erosion. The ability to reduce flooding depends upon the wetland's size, shape, and location in the watershed. The benefits from these may be direct, in the form of reduced losses from a particular flood, or indirect, in the form of reduced taxes because less investment is needed in flood control structures.

Regulation and Absorption

- **climate regulation**
- **watershed protection and water catchment**
- **erosion prevention and soil protection**
- **storage and recycling of human waste**
- **storage and recycling of energy**
- **toxics absorption**

(From deGroot, 1988 and Filion, 1988.)

FUNCTIONS – (CAPABILITIES)	EXAMPLES OF PRODUCTS, SERVICES AND EXPERIENCES SUPPORTED BY WETLANDS	EXAMPLES OF BENEFITS TO SOCIETY DERIVED FROM WETLANDS
Life-support		
Regulation/Absorption	Climate regulation, toxics absorption, stabilization of biosphere processes, water storage, cleansing.	Flood control (lives saved, $ saved), contaminant reduction, clean water, storm damage reduction, health benefits, erosion control.
Ecosystem Health	Nutrient cycling, food chain support, habitat, biomass storage, genetic and biological diversity.	Environmental quality, maintenance of ecosystem integrity, risk reduction (and related option values).
Social/Cultural		
Science/Information	Specimens for research, zoos, botanical gardens, representative and unique ecosystems.	Greater understanding of nature — locations for nature study, research, education (field trips).
Aesthetic/Recreational	Non-consumptive uses such as viewing, photography, bird-watching, hiking, swimming.	Direct economic benefits to users' personal enjoyment and relaxation, benefits to tourist industry, local economy.
Cultural/Psychological	Wetland uses may be part of traditions of communities, religious or cultural uses, future (option) opportunities.	Social cohesion, maintenance of culture, value to future generations, symbolic values.
Production		
Subsistence Production	Natural production of birds, fish, plants (e.g. berries, rushes, wild rice).	Food, fibre, self-reliance for communities, import substitution, maintenance of traditions.
Commercial Production	Production of foods (e.g. fish, crops), fibre (e.g. wood, straw), soil supplements (e.g. peat).	Products for sale, jobs, income, contribution to GNP.

Figure 4.1 Translating wetland functions into benefits valued by society.

Adapted from deGroot, 1988 and Filion, 1988.

In addition, wetlands act as "environmental filters", particularly in agricultural and urban areas where runoff carries with it an excess of nutrients and often toxic chemicals. Through wetland vegetation life cycles, such chemicals are frequently removed from the water. The advantage of this "cleansing" has environmental and social benefits by reducing water quality contamination in downstream and groundwater areas. For instance, wetlands are widely used throughout North America as sites for secondary sewage or stormwater treatment.

In the prairie region, wetlands have an influence on micro-climate and groundwater by stimulating local precipitation and replenishing groundwater supplies. As prairie wetlands are drained, such functions become threatened. What impact does such modification have upon crop yields? What are the long-term effects upon dryland farming? What other benefits of farmers and other rural residents are affected by the changes?

These and similar questions must be addressed in wetland evaluation to allow full consideration of the links between alterations to the ecology and their social and economic implications.

Ecosystem Health

Occupying a unique position in the transitional zone between aquatic and terrestrial environments, wetland marshes, swamps, and shallow water areas are often highly productive or "fertile" ecosystems. Wetlands support a complex web of energy transfers and associated flora and fauna. For instance, marsh and swamp habitats produce four times the net primary nutrient production of lakes. However, nutrient-poor wetlands, such as bogs and some types of fens, are biologically more simple, with limited floral or faunal diversity.

Traditionally, wildlife values, particularly for waterfowl, have been the prime reason for the recognition and protection of wetlands. For instance, prairie potholes provide habitat for the production of roughly 50% of the North American waterfowl population. Wetlands in estuarine or coastal areas are essential to the maintenance of various fish and invertebrate stocks. Freshwater wetlands also provide essential spawning habitat for many fish, amphibian and invertebrate species.

Wetlands support a variety of mammals and a large number of birds of prey, songbirds, and shorebirds. Of the 95 species of fish, birds, animals, or plants currently classified as Threatened or Endangered in Canada, 40 to 45 species utilize wetlands as critical habitat.

The biological functions, including diversity of habitat, are often the most significant element of the social and cultural value of wetlands. For instance, it is the vast concentrations of migrating waterfowl, shorebirds, raptors and other avian fauna which attract large numbers of hunters, bird watchers, photographers and hikers. These activities often generate significant regional economic benefit due to tourism and recreation spending.

Ecosystem Health
- **maintenance of biological diversity**
- **biological control**
- **maintenance of nutrient cycle/food web**
- **providing migration habitat**
- **providing a nursery habitat**
- **biomass storage**

4.4 Social/Cultural Functions

Science and Information
Aesthetic and Recreational
Cultural/Psychological

Wetlands have traditionally been a source of human sustenance. In times past, wetlands yielded for human use an abundance of staples including food and clothing, whereas today yet another form of sustenance is derived in the form of human recreation, a renewal of one's links with the environment. Watching and appreciating wetland wildlife and life processes in a marsh, for example, brings pleasure and value to an increasing segment of Canadian society.

Wetlands make a cultural contribution to the lifestyles of Canadians who hunt, fish, trap and gather wetland "products" as part of their day-to-day livelihood.

Social/Cultural Functions
- **recreation and tourism**
- **aesthetics**
- **spiritual/traditional**
- **cultural and artistic inspiration**
- **educational and scientific information**
- **social cohesion**
- **bequest to future generations**

For them, the health of the wetland is singularly important to their own well-being. For others, wetlands may provide scenic and aesthetic values; for still others, values may be derived by simply being in close proximity to a wetland (i.e. increased residential or land values).

Wetlands also have social and cultural value because of the scarcity and, hence, uniqueness and representativeness values, attracting attention because of those special qualities and setting them apart. While such characteristics may also have important biological and hydrological value, their attraction for tourism and recreation value can be significant. In addition, wetlands can have a "use", "option" or "existence" value — value because by being there, they offer diversity to our lifestyle. As well, wetlands provide education and scientific value for understanding environmental issues.

Wetland evaluation needs to recognize the range of values which can be associated with wetlands and needs to include means of incorporating these effectively into the process.

Production Functions

- **industry**
- **water supply**
- **food**
- **building, construction and manufacturing materials**
- **fuel and energy**
- **minerals**
- **medicinal resources**

Photo: Canadian Sphagnum Peat Moss Association

Peat harvesting for horticultural applications, southeastern Quebec.

4.5 Production Functions

Subsistence Production
Commercial Production

Wetland production functions incorporate a complex variety of biological, hydrological and social/cultural aspects, and fall into two general categories: subsistence and commercial. For instance, high biological production in the form of waterfowl populations raised and reared in remote wetlands, creates value offsite where consumptive (hunting) or non-consumptive (tourism, photography) uses stimulate a variety of economic impacts and linkages, ranging from specialty equipment and clothes sales to accommodation, food and services sales. Some inshore and ocean commercial fishery catches, as well as the freshwater commercial fishery are dependent upon the production of fish and invertebrate stocks which spend part of their life cycle in wetlands. Interruptions to such fisheries operations can have dramatic regional consequences, in fishery closures and loss of employment. Likewise, resource utilization such as peat, cranberry and medicinal plant production, wood harvesting, wild rice harvesting and fur harvesting are production functions of wetlands. The subsistence and economic aspects of these need to be part of any evaluation. Such production functions may have regional and inter-regional market and non-market evaluation effects in terms of dollar flow or lifestyle enhancement.

When considered in isolation of regulation functions and social/cultural functions, converted wetlands, especially for agricultural production purposes such as market gardening, have extremely high per hectare economic production functions. Recent studies suggest, however, that as agricultural intensity decreases, returns on investment (i.e. wetland drain-

ing and/or dyking) can also decrease to marginal levels if little or no public subsidy exists. This suggests that at some point, natural system production function evaluation will exceed the conversion economic production function evaluation. Such considerations must be given greater attention in future wetland conversion discussions especially if the alternative use or conversion of the wetland cannot be reversed.

As the evaluator moves from Stage Two to Stage Three, "Specialized Analysis", emphasis will be placed upon estimation of economic values within a comprehensive benefit/cost framework for purposes of wetland and project comparison. Stage Three analysis will require economic production function tools common to economics, and will cover marketed and non-marketed goods and use and non-use values (Figure 4.2).

4.6 Future Values

All benefits which a wetland can support may not currently be present. Future development may have an incremental effect upon a particular type of wetland or wetland function making that particular wetland type or function more valuable. As prairie potholes are drained, the residual potholes increase in value as waterfowl production sites. Their value will likely continue to increase in the future. Growing demands for recreation may increase the need for access to particular wetlands. Loss of alternative habitats may direct new pressures to a particular site for fish breeding or for migratory bird staging. Evaluators should be cognizant of future/potential benefits that may derive from the wetland.

4.7 Summary

Wetland functions are varied and diverse, depending upon wetland class, location, and size. Any evaluation of wetland functions must take into account all of:

- the regional and inter-regional linkages of such functions;

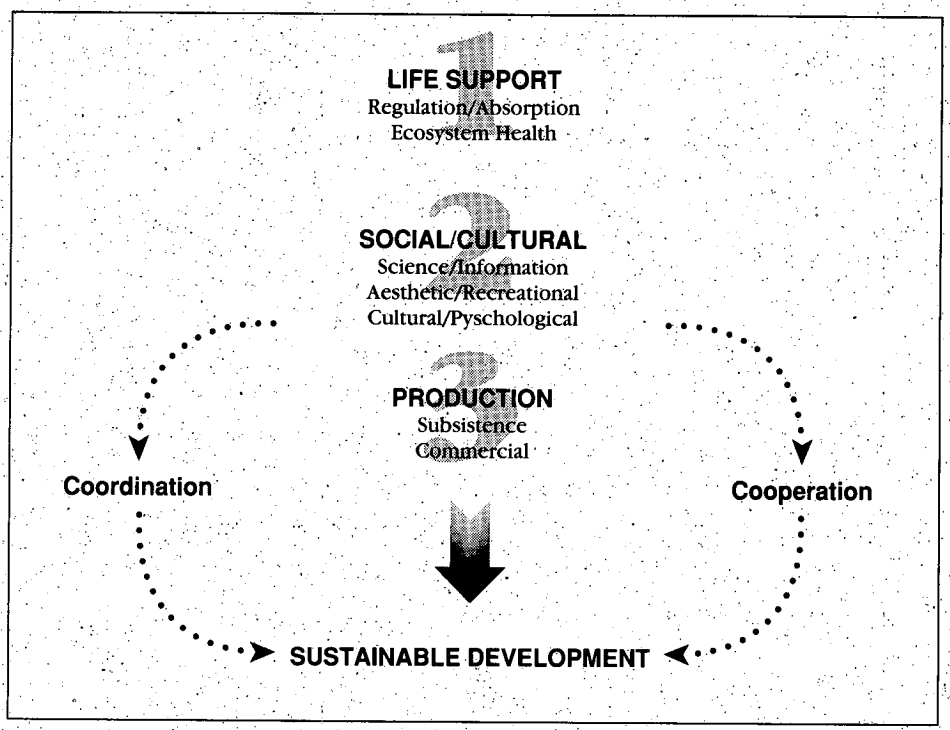


Figure 4.2 Relationship of wetland functions to societal values.

- the associated social/cultural and production functions of biological and hydrological/biogeochemical natural system attributes;
- the monetary and non-monetary value of such functions and relationships; and
- the potential costs, both direct and indirect, resulting from potential wetland conversion.

In the latter part of this Guide, means are suggested by which these complex interrelationships can be recognized and integrated into the evaluation process. Evaluation of wetlands will provide a sense of worth for wetland sites under review.

5.0 Wetland Management

5.1 Introduction

Previous sections describe the important functions of wetlands that support benefits of considerable public value. Wetland management principles and practices also have important implications for the public good. As a result, wetlands, no matter where they lie, should be viewed in the context of their role or function in the ecosystem and their potential benefit to society as well as their benefits to organizations and individuals.

This philosophy of wetland use recognizes that many of Canada's wetlands, particularly those in southern Canada, are on private land. Because there are so many privately-owned wetlands, direct public intervention through acquisition - except in cases of national or provincially significant wetlands - is not possible nor should it be necessary. An increasingly environmentally-conscious citizenry is becoming more receptive to private stewardship of publicly valued resources such as wetlands. Stewardship includes the commitment of private landowners to manage privately-owned resources for the public good. Stewardship may involve non-monetary recognition (i.e. plaques), or monetary compensation (i.e. leases or paid easements).

Traditional methods of land use management and controls should also be considered, especially for situations where stewardship is not a possibility and proposed wetland conversion will detrimentally impact significant wetland functions and/or important public values. While existing land use control and approval mechanisms now exist in all private land areas and most Crown land areas, few such mechanisms have been developed to deal specifically with wetland conversion. New efforts at wetland evaluation are needed to identify the importance of wetlands and to help target stewardship and land use controls. As well, a process which can identify those responses (wetland management plans, wetland protection, stewardship plans, or wetland conversion guidelines) is required as the demand increases for environmentally sensitive wetland conversion. This Guide will assist in identifying those appropriate responses.

While most land in Canada is public land, many of Canada's important wetlands are on private land.

LAND AREA OWNERSHIP IN CANADA EXPRESSED AS PERCENTAGE OF TOTAL AREA

Province or Territory	Public land* (%)	Private Land (%)
Newfoundland	95.6	4.4
Prince Edward Island	12.9	87.1
Nova Scotia	32.7	67.3
New Brunswick	45.9	54.1
Quebec	92.3	7.7
Ontario	88.9	11.1
Manitoba	78.8	21.2
Saskatchewan	60.1	37.9
Alberta	72.2	27.8
British Columbia	94.8	5.8
Yukon	99.9	<0.1
Northwest Territories	99.9	<0.1
CANADA	90.3	9.7

All figures have been rounded to reflect their approximate nature.
* Source: Statistics Canada, 1990.

5.2 Approval Process

Within Canada, there are three land ownership types: (1) private land of various types including individual, corporate, cooperative, and native; (2) federal Crown land; and, (3) provincial Crown land. Private land use is governed by a variety of provincial/territorial/municipal/community land use regulations and controls. In typical private land use approval situations, a municipal authority will examine the request for development and identify its compliance with land use and building regulations (Figure 5.1). Where the proposed development complies with policies, official plans, zoning and site plan controls, permission to develop is given. Resulting impacts upon affected wetlands are frequently not considered in land use approval reviews. This problem rests largely with the development review process and the lack of environmental criteria such as resulting wetland impact. This issue is of special concern in rural areas of Canada. In addition, wetlands can also be detrimentally impacted by private landowners in situations that do not require an approving authority's review. For instance, many individual small-scale agricultural projects which have drained sloughs and potholes, have had detrimental cumulative effects upon regional wetlands.

It is for that reason, and the recognition that legislated land use controls are not always the best solution, that the concept of private wetland stewardship is being encouraged.

5.3 Conservation and Protection Mechanisms

There are a variety of wetland conservation and protection tools including purchase and designation of significant wetlands as wildlife or ecological reserves, zoning for conservation, parkland, open space or hazard lands designation and private landowner commitment. Such efforts fall within policy, regulation and intervention mechanisms or good stewardship practices. The approach to be used will vary, depending on local circumstances and individual characteristics of the wetlands. Emphasis should be placed upon the applicability of the approach and its feasibility. Local situations can vary as a result of several elements:

- jurisdictional circumstances;
- wetland characteristics;

Municipalities need to develop increased consideration of wetland impact in their land use approval processes.

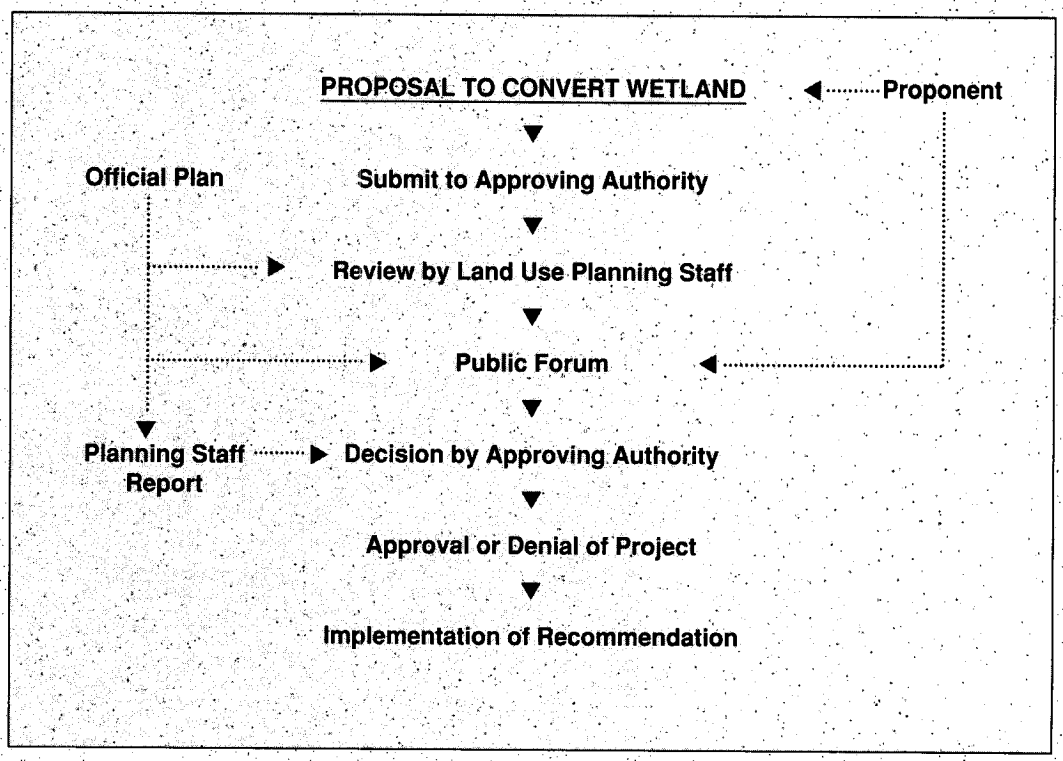


Figure 5.1 Typical approval process for development of a wetland.

- extent of government subsidies that indirectly encourage conversion;
- availability of technical information; and,
- the nature of development.

Government intervention in wetland conservation and protection may involve land use control and formulation of policies governing competing uses. For instance, agricultural subsidy payments and tax credit for resource conservation practices are policy matters that affect wetlands.

Private stewardship can be affected by the awareness that landowners have of wetland functions and values. Education and extension programmes, including conservation awards, are vehicles which can encourage such stewardship. This Guide provides demonstration of the broader evaluation implications of wetlands.

5.4 Federal / Provincial / Territorial / Municipal Legislation and Policies

Each senior government affects wetland conversion through its respective legislation and policies. Therefore, any wetland evaluation must consider the degree to which a wetland is positively or negatively impacted by government policies and regulations. A number of senior government departments and agencies which typically affect wetlands include: agriculture, forestry, wildlife, environment, natural resources, finance and treasury (taxation), municipal affairs, water resources and Crown corporations such as electrical utilities and resource extraction industries. Municipal government (regional, rural, city, town) policies and regulations affecting wetlands include: land use plans, zoning by-laws, site plan controls and building regulations. Examples of key government policy areas and regulations are found in Appendix D.

Private Land

Private land use activities are controlled by municipal policies and regulations. Such policies and regulations vary across Canada and within individual provinces and territories depending upon existing land use activity and overriding provincial/territorial legislation which establishes local land use authority. Generally, municipal policies and regulations are developed to reflect broad land use development and planning considerations as well as local issues. Where wetlands are considered to have value, municipal policy frequently recognizes special considerations for wetland development and management. Conversely, where wetlands are not valued as a public good, municipal policies usually do not address their conversion. This Guide is one means to demonstrate to municipal councils the range of potential wetland functions and their benefits, and may lead to municipal policies which better address local wetland functions and conversion issues. Tools available include development performance standards, wetland zoning classifications, modified development review procedures and local municipal environmental impact assessment methods (see Appendix D).

Wetland policies and regulations need attention at each level of government.

Private Land

- **most wetlands at risk in southern Canada are located on private land**
- **municipal land use policies need to address the issue of wetland conversion**

Crown Land Controls

Crown land falls under federal, provincial/territorial or municipal jurisdiction and direct or indirect (i.e. in trust corporations) ownership. These Crown lands include parks, public use areas, sensitive or significant natural or cultural features and large tracts of Crown land in unsettled areas of Canada. Where Crown land is designated for specific purposes, its use is usually defined through management

Mechanisms to protect wetland values include:

- **Management plans**
- **Protection and designation plans**
- **Mitigation plans**
- **Stewardship plans**

plans which may or may not have legislative status. In the North, land use permits and special rights of use frequently allocate resource use.

Crown land use review mechanisms often include requirements for Environmental Impact Assessment and compliance with official land use plans. Where such requirements do not exist, public land use regulations are available to protect or allocate wetlands.

5.5 Summary

As we come to better understand wetland functions and their value to society, wetland values can be more fully incorporated into private and Crown land use decision making. Where tools for such consideration are not available, a variety of policy instruments and efforts of education and extension will be required to facilitate the recognition of the role wetlands play and the benefits associated with their functions.

Wetland protection and management requires more than regulation. Stewardship is of key importance.

6.0 Evaluation Method

6.1 Introduction

Land use decisions are traditionally based upon a number of interconnected factors, including cost to develop; cost to service and operate; and cost to the taxpayer and/or shareholder. However, land use decisions frequently do not account for the full range of costs to social and environmental health (i.e. the opportunity costs of development). Often these latter costs are not as well defined as the former.

Several of these factors also affect another chief determinant, political decision making. Support to the political decision-making process through a clearer articulation of the functions of wetlands and the value of the benefits they provide should lead to wetland-related decisions which are more defensible and less contentious.

Proposals to convert wetlands may affect whole or part of the wetland, or only part of it or some of the functions it supports. This depends greatly on the wetland location and the type and scale of the proposed activity. While it is likely easier to protect a wetland as an entity, (i.e. as a "critical mass"), rather than trying to value and defend against incremental losses of a wetland and its various functions, the need for evaluation of partial and indirect wetland impact is also important. For instance, a project nearby a wetland may discharge waste into a wetland drainage system or draw down groundwater for cooling or other purposes, thereby altering wetland values. In some cases this may seriously damage some functions of the wetland. In others, it may be easily accommodated within the resiliency of the wetland system. Therefore, it is important to consider the cumulative impact to wetlands, caused by direct and indirect project and program activity. As thresholds for wetland functions are violated by successive incremental losses, the decision maker must decide:

1. what functions and values to society are affected;
2. to what extent;
3. where, if at all, "to draw the line" and what is the critical threshold; and,
4. are there other options?

The purpose of this Wetland Evaluation Guide is to give direction to those decisions (Figure 6.1).

The focus of this Guide is to better understand the full range of wetland values, potential impacts to those values resulting from actions of people, and the methods required to provide objective assessment of conservation or conversion.

6.2 How to use this Guide

As in any pre-set evaluation process, the application is only as good as the information available and the evaluator's use of that information. The intent of this Guide is to avoid the development of complex new models of evaluation for every affected wetland. Instead, this Guide provides a frame of reference for consistent wetland evaluation. Therefore, by its very nature, it can be expected that wetlands at either extreme of the evaluation continuum (i.e. internationally significant and negligible local value wetlands) will not need to be thoroughly evaluated using this Guide. In the case of the internationally significant wetlands, project appraisal will very likely require detailed comprehensive environmental impact assessment. For wetlands which have negligible value at the local level, it may not be useful to spend much time gathering information. This evaluation process should recognize those extremes.

Generally, however, most project proposals having the potential to directly or indirectly impact on wetlands will fit into the three-stage evaluation model. This model recognizes the need for:

- an evaluation process which is systematic and comprehensive;
- an evaluation process which is easily understood;
- an evaluation process which moves from the general to more sophisticated levels of analysis as wetland and project complexity increase;
- an evaluation process which recognizes the diversity of wetland functions and potential project impacts; and
- an evaluation process that is primarily built upon existing primary and secondary sources of information.

The intent of this Guide is to avoid the development of complex new models of evaluation for every affected wetland. Instead, this Guide provides a frame of reference for consistent wetland evaluation.

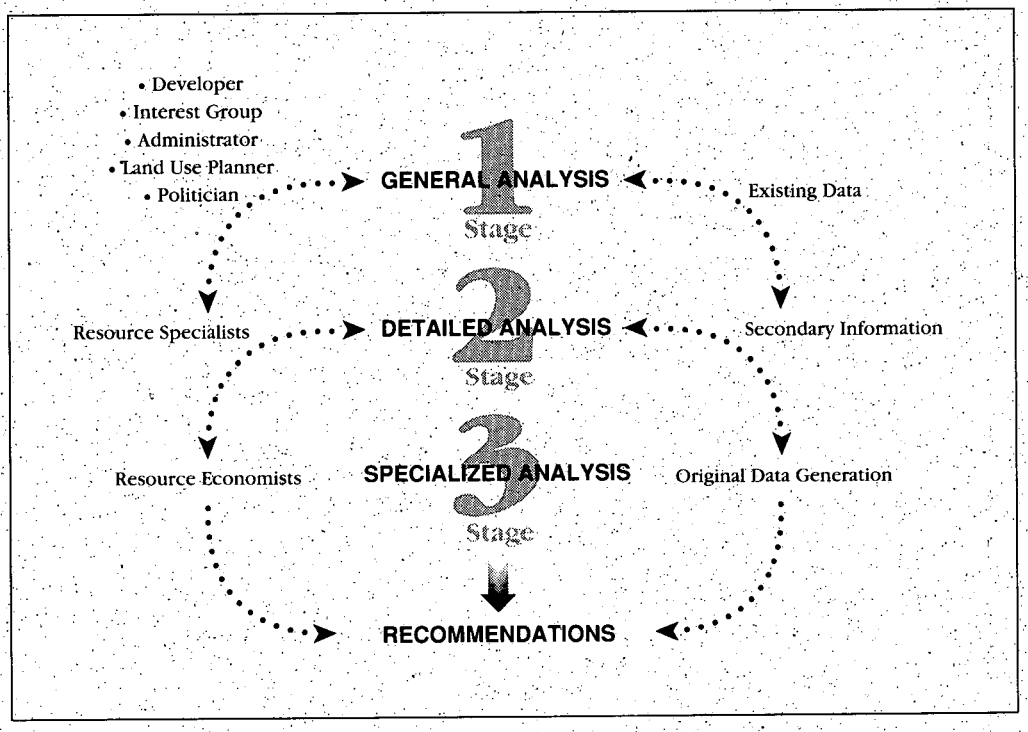


Figure 6.1 Generalized example of the staged evaluation.

Section 7, Evaluation, sets out a three-stage approach whose evaluations range from the simple and inexpensive to the more complex and costly. When one stage fails to trigger a decision, then the next stage is invoked until finally, if necessary, a very detailed evaluation is completed in Stage Three. As one moves from Stage One through to Stage Three in response to the relative significance of the wetlands and the impacts upon them, the information required to provide appropriate evaluations becomes increasingly sophisticated and detailed, as does the expertise needed to make the evaluations.

Stages One and Two can largely be completed by the user. Completion of Stage Three will require specialists in wetlands ecology, resource economics and survey methodology.

6.3 Alternatives

It is clear that there is a variety of alternative possible recommendations, ranging from little or no change to project concept, to minimal or minor change and, finally, to major change or even project denial. Therefore, some projects may proceed without concern for potential negative impacts, while others may require mitigation or modification in order to minimize detrimental wetland impact. Other projects may be more appropriately relocated away from the potentially affected wetland. And still other projects may require significant design changes or a rethinking of project goals given the undesirable impacts anticipated.

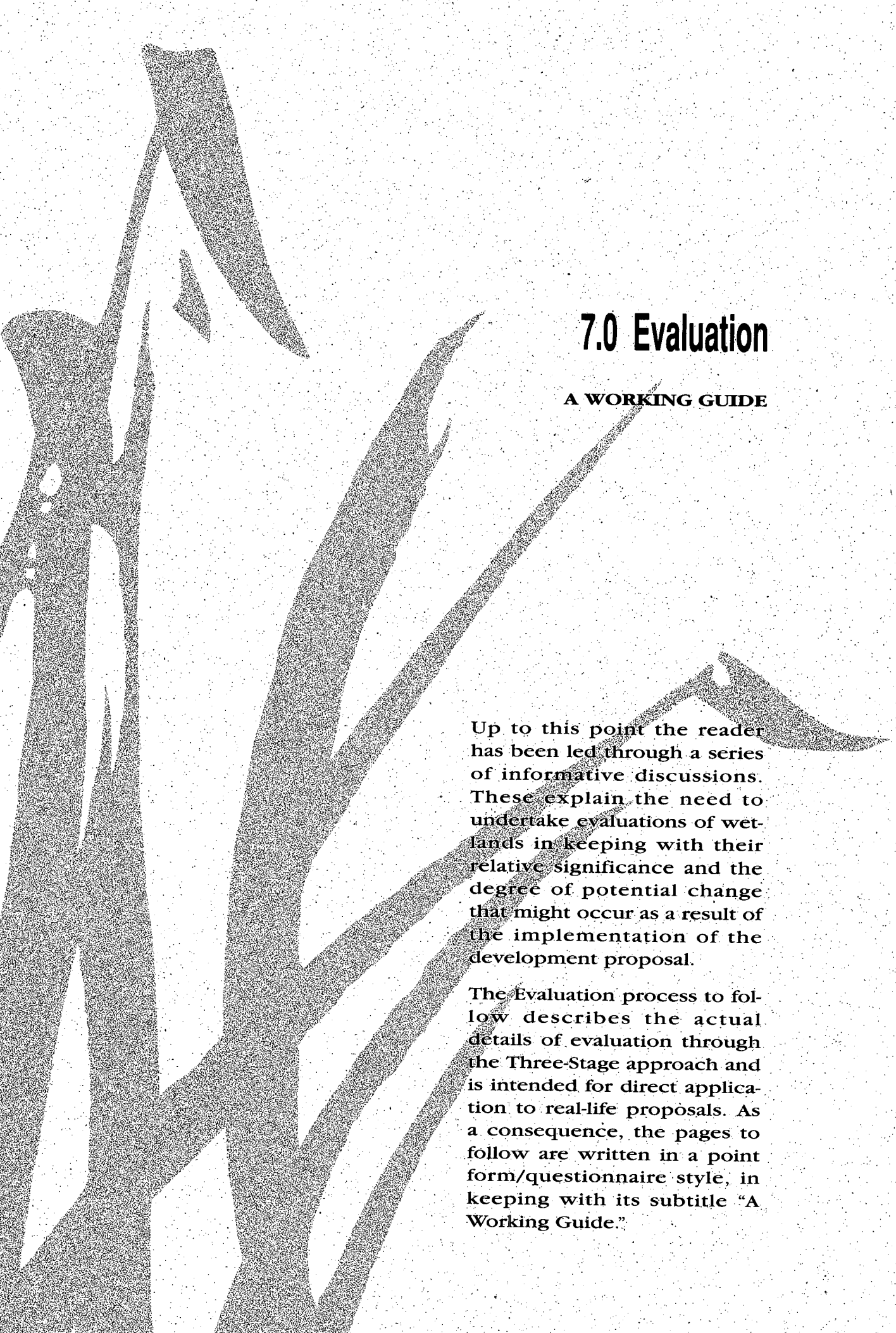
This range of alternative considerations has been built into the evaluation process of Section 7.

6.4 Summary

The evaluator should complete Section 7, Evaluation, by following through each step in a sequential manner. Completeness, objectivity, and accuracy are critical.

Photo: Canadian Wildlife Service

Incorporation of public access into the design of the Waterfowl Park, Sackville, New Brunswick benefits both people and wildlife.



7.0 Evaluation

A WORKING GUIDE

Up to this point the reader has been led through a series of informative discussions. These explain the need to undertake evaluations of wetlands in keeping with their relative significance and the degree of potential change that might occur as a result of the implementation of the development proposal.

The Evaluation process to follow describes the actual details of evaluation through the Three-Stage approach and is intended for direct application to real-life proposals. As a consequence, the pages to follow are written in a point form/questionnaire style, in keeping with its subtitle "A Working Guide."

Photo: J. Pojar

Bogs are an integral part of the coastal zone of the Pacific region.

7.1 Introduction

Please work through this section in sequence.

Growing evidence clearly demonstrates the very important role that wetlands play in our total environment. This Wetland Evaluation Guide has been developed to assist planners, municipal administrators, politicians, developers and landowners to make informed land use decisions concerning wetland resources. This section of the Guide provides a tiered, step-by-step evaluation process, moving from basic to more sophisticated analyses, and from known documented and recognized values to more specific values which must be researched in detail for the particular wetland under review. The evaluator - this could be the planner, administrator, politician or wetland conversion proponent/opponent or a specialist whom they have retained - moves from Stage One to Stage Two and finally to Stage Three only if the preceding stage is unable to clearly demonstrate a suitable land use preference. In most situations, not all stages will have to be applied. This permits efficient use of resources and time to inventory only factors which must be addressed to reach a decision.

Land use decisions affecting wetlands have frequently been based primarily upon the economic worth of a proposed land use activity. While economic worth is important, other costs or impacts of such activity - the loss of wetland functions and their value to society - are often not properly identified. This Guide provides the basis for a comparison of the full range of wetland values.

To apply the Guide proceed sequentially through each step as directed. This evaluation should be undertaken only if the proposed land use or project development may directly or indirectly affect a wetland or wetland system. While many small projects (e.g. agricultural drainage) may not appear to be significant, their effect upon a wetland or wetland complex may be as important as large development proj-ects. All potential impacting projects should be screened.

7.2 Process

7.2.1 Background

Name of Evaluator _____

Address _____

_____

_____

Date _____

7.2.2 Project Description

This section describes the proposed project. It is essential that the project be describable before proceeding with this section.

a. Summary of Project *(fill in and check the boxes)*

Name of Project _____

i. Is it a public or private project? ❑ Public ❑ Private

ii. Does it require land use approval? ❑ Yes ❑ No

iii. Where is it located? _____

_____

iv. Is it proposed in or near a wetland? ❑ In ❑ Near

v. Will the wetland be fully or partially drained? ❑ Fully ❑ Partially
fully or partially dredged? ❑ Fully ❑ Partially
completely or partially filled? ❑ Completely ❑ Partially
fully or partially dyked? ❑ Fully ❑ Partially
fully or partially flooded? ❑ Fully ❑ Partially
fully or partially enhanced/restored? ❑ Fully ❑ Partially
Other _____

_____

_____

b. Type of Activity Proposed *(check appropriate boxes; if necessary describe under "other")*

i. ❑ Industrial

ii. ❑ Commercial

iii. ❑ Residential

iv. ❑ Institutional

v. ❑ Recreational/Tourism

vi. ❑ Agriculture

vii. ❑ Transportation/Utility Corridor

viii. ❑ Habitat Development

ix. ❑ Forestry

x. ❑ Other (describe) _____

_____

_____

xi. Statement of Project Purpose _____

_____

_____

xii. Precise Description of Activity _____

_____

_____

c. *Status of Project* *(land use controls which might affect the project)*

i. Jurisdiction of Approving Authority

- ❑ Federal
- ❑ Territorial/Provincial
- ❑ Municipal/Regional
- ❑ Native

ii. Type of Mandatory Review

Mandatory review required?

❑ Yes ❑ No

Environmental Impact Assessment required?

- ❑ Yes ❑ No Federal
- ❑ Yes ❑ No Territorial/Provincial
- ❑ Yes ❑ No Municipal
- ❑ Yes ❑ No Native

iii. Does the project fall under Municipal Development Control?
(if yes continue, if no go to "iv")

Type of Control:

- ❑ Approved Development Plan
- ❑ Approved Zoning By-Law
- ❑ Approved Environmental Impact Assessment (EIA)
- ❑ Approved Performance Standards
- ❑ Other (describe)_____

_____

_____

iv. Status of Proposal

- ❑ Not submitted
- ❑ Under review
- ❑ Approved
- ❑ Denied
- ❑ Under appeal
- ❑ Requires zoning

v. Sources of Funding *(check one or more)*

- ❑ Private financing
- ❑ Public financing
- ❑ Public subsidy

If public subsidy, please name program_____

_____

_____

vi. Level of Project Understanding/Refinement *(check one)*

- ❑ At very preliminary stage; little or no economic cost/benefit analysis
- ❑ Preliminary stage; conceptual drawings, economic cost/benefit analysis, environmental impact considerations
- ❑ Detailed design; design drawings, cost/benefit analysis (all components), and Environmental Impact Assessment

vii. Potential for Stewardship

Stewardship represents landowner commitment to manage the wetland in society's interests. Does that potential exist for this wetland?

- ❑ Yes
- ❑ No
- ❑ Maybe

If yes or maybe, what steps are needed to institute a stewardship program? _____

_____

_____

_____

_____

d. Project Production Summary

This section examines the products (i.e. benefits and disbenefits) which the project might generate.

i. Has an economic analysis been completed for the project?

- ❑ Yes *(continue to "ii")*
- ❑ No *(go to "iv")*

If yes, by whom: ❑ by proponent in-house
❑ by professional consultant
❑ other *(name/agency/organization)* _____

_____

_____

Information about analyst

Name _____

Address _____

_____

Telephone No. _____

Date analysis prepared _____

ii. Status of Economic Findings *(evaluator's opinion only)*

- ❑ Detailed, thorough economic findings
- ❑ Preliminary economic findings
- ❑ No economic findings *(go to "iv")*
- ❑ Information not available *(go to "iv")*

iii. Summary of Findings/Project Benefits *(if no estimates, check box; if estimates are available indicate information on line provided)*

- ❑ Permanent jobs (person/years)_____
- ❑ Permanent contribution to new area wages per year_____
- ❑ Permanent contribution to new area spending (total per year) _____
- ❑ Construction jobs (person/years)_____
- ❑ Construction contribution to new area wages per year_____
- ❑ Construction contribution to area spending (total per year)_____
- ❑ Increased production by type (e.g. agriculture, forestry, tourism) _____

_____

- ❑ Other benefits_____
- ❑ Amenity Contribution _____

iv. Summary of Potential Disbenefits *(check the appropriate boxes)*

There are expected problems that may occur because of the project. These potential problems are the preliminary issues that will need to be addressed as part of the project review.

❑ Noise pollution	❑ Water drawdown	❑ Recreational loss
❑ Air pollution	❑ Habitat loss	❑ Economic loss
❑ Water pollution	❑ Aesthetic loss	❑ Other _____

e. Summary of Expected Level of Selected Project Impacts *(check box for high, moderate or low)*

The following table provides project information which will assist in subsequent considerations of potential project impact upon the wetland under review. This table summarizes the evaluator's views based upon existing known information.

POTENTIAL WETLAND IMPACTS	LEVEL OF EXPECTED IMPACT: HIGH	MODERATE	LOW
Noise Pollution			
Air Pollution			
Water Pollution			
Water Drawdown			
Habitat Loss			
Aesthetic Loss			
Recreational Loss			
Other_____			

POTENTIAL ECONOMIC IMPACTS	LEVEL OF EXPECTED IMPACT: HIGH	MODERATE	LOW
Employment			
Training			
Construction Spending			
Operation Spending			
Taxes			
Indirect Spending*			
Flood Protection			
Other_____			

*(e.g. Tourism)

This table will be particularly useful in filling in Step One of Stage Two (see Section 7.5).

f. Project Summary *(project description, sources, and a summary of findings that may be useful in further analysis)*

7.2.3 Wetland Description

This section describes the affected wetland. It is essential that the wetland be describable before proceeding.

a. Wetland Location

Province/Territory _____

Common Place Name (if any) _____

Nearest Urban Centre _____

Legal Description (if any) _____

Land Designation: ❑ Public
❑ Private
❑ Protected Area
❑ Other _____

If public, name of area/site (if any) _____

If protected, name of agency and status _____

b. Map

Show location of wetland and proposed project in relation to region. *(Draw or place map here, or attach map and/or project plan to back of this page. Indicate direction of north and ensure that map contains a scale.)*

c. Wetland Context

This provides a brief description of the wetland and preliminary relationship to the project.

i. Wetland Complexity **Size**

Is this a single wetland ❑ Yes ❑ No _____ ha ( ) acres

Is this a wetland complex* ❑ Yes ❑ No _____ ha ( ) acres

*(*i.e. a series of more than one wetland)*

ii. Wetland Class

a) Single Wetland *(check one only)*	**b) Wetland Complex** *(check all classes present, and write number if it occurs more than once)*	**c) Wetland Classification**
❑ Bog	❑ Bog _____	❑ Temporary
❑ Fen	❑ Fen _____	❑ Seasonal
❑ Swamp	❑ Swamp _____	❑ Permanent
❑ Marsh	❑ Marsh _____	
❑ Shallow Water	❑ Shallow Water _____	

iii. Has this wetland been previously impacted?

❑ Yes ❑ No

If yes, describe _____

_____

_____

_____

_____

_____

_____

7.3 Preliminary Screening

This section examines two key considerations prior to the application of the three evaluation stages.

These considerations relate to:
1. Potential for project relocation
2. Project redesign
3. Wetland viability

7.3.1 Potential for Project Relocation

This section examines the possibility of relocating the project away from the wetland, in order to reduce potential direct or indirect effects that may occur. It should be completed in association with the proponent. ***(The proponent should be made aware of the subsequent evaluation procedure which may be necessary if relocation is not undertaken or is not possible).***

a. How important is the wetland site for this project?

- ❑ Essential *(go to 7.3.2)*
- ❑ Important *(go to 7.3.2)*
- ❑ Desirable *(go to 7.3.2)*
- ❑ Unnecessary *(go to "b")*
- ❑ Unknown *(go to 7.3.2)*

b. Is an alternative location available?

- ❑ Yes Where? _____ *(go to "c")*
- ❑ No *(go to 7.3.2)*

c. Does an alternative location create detrimental impacts to other uses?

- ❑ Yes *(go to 7.3.2)*
- ❑ No *(go to "d")*

d. What is the rationale for relocation of the project, or why must the project be located on this wetland site? _____

_____

_____

e. Project recommended for relocation?

- ❑ Yes *(go to "f")*
- ❑ No *(go to 7.3.2)*

f. Is proponent prepared to relocate?

- ❑ Yes *(if alternative location recommended and proponent accepts evaluation, stop here)*
- ❑ No *(go to 7.3.2)*

_____ _____

Evaluator's Signature Date

CONCLUSION OF ALTERNATIVE PROJECT SITE CONSIDERATION

7.3.2 Project Redesign

A proposed project may require a simple or difficult redesign or change in project management practice to minimize wetland effects. This section examines that opportunity. You may need to reconsider this section after the Stage One and Stage Two evaluations.

a. Is project redesign possible?

- ❑ Very likely *(go to "b")*
- ❑ Possibly *(go to "b")*
- ❑ Not possible *(go to "f")*

b. Will the redesign significantly reduce the impact to the wetland?

- ❑ Yes *(go to "c")*
- ❑ No *(go to "f")*

c. If the project can be redesigned, will a redesign require other conditions?

- ❑ Yes *(go to "d")*
- ❑ No *(go to "f")*

d. What are the conditions for redesign?

- ❑ Rezoning of other land
- ❑ Subsidies
- ❑ Other (specify) _____

e. Are these conditions achievable?

- ❑ Very likely *(go to "j")*
- ❑ Possibly *(go to "j")*
- ❑ Not possible *(go to "f")*

If not possible, why? _____

f. Are changes in the way the project is managed possible?

(e.g. landscaping, cultivation practices, design of infrastructure)

- ❑ Very likely *(go to "g")*
- ❑ Possibly *(go to "g")*
- ❑ Not possible *(go to "7.3.3")*

g. Will changes in the way the project is managed significantly reduce impact to the wetland?

- ❑ Yes *(go to "h")*
- ❑ No *(go to "7.3.3")*

b. What are the conditions for a change in the way the project is managed?

- ❑ Subsidies
- ❑ Alteration to regulations
- ❑ Other (specify) _____

i. Are these conditions achievable?

- ❑ Very likely *(go to "j")*
- ❑ Possibly *(go to "j")*
- ❑ Not possible *(go to "7.3.3")*

If not possible, why? _____

j. Interim Recommendation

- ❑ The project should be redesigned; or
- ❑ The way the project is managed should be modified; or
- ❑ The proponent and approving authority will proceed to modify the project to protect the wetland.
- ❑ The evaluation should proceed. *(go to "7.3.3")*

The evaluator should consider such redesign or management practices in association with the proponent and/or the approving authority. Once discussions have been held, the evaluator should proceed to complete "k".

k. Record of Action

- ❑ Project satisfactorily redesigned; or
- ❑ Project management practices satisfactorily modified; or
- ❑ Proceed to Section 7.3.3

Conclusion of Project Redesign Consideration

7.3.3 Wetland Viability

Wetland viability is the key consideration in the process of wetland and proposed project evaluation. A wetland, which has been severely and detrimentally affected over time and cannot be reasonably rehabilitated, should be considered for detailed analysis in Stage Two, only if it represents one of the last such wetland types in the region. Otherwise, a wetland that has been impacted previously beyond critical thresholds of viability should not be considered further and the project should be recommended for development.

Preliminary Screening: Cumulative Impact

This screening provides an evaluation of the status of the wetland in a temporal and spatial context. It indicates the degree to which the wetland has been impacted previously by direct or indirect human-induced activities and the degree to which the wetland will likely continue to deteriorate with and without the cumulative effects of the proposed project.

a. Results of Past Effects upon the Wetland

Has the wetland decreased in size during the past five years?

- ❑ Yes
- ❑ No
- ❑ Don't know *(go to "7.4")*

If yes, by how much: ❑ Highly affected
❑ Moderately affected
❑ Minimally affected

Is the wetland known to be detrimentally affected by other nearby projects or drainage system changes?

- ❑ Yes
- ❑ No
- ❑ Don't know *(go to "7.4")*

If yes, by how much: ❑ Highly affected
❑ Moderately affected
❑ Minimally affected

Have animal or plant communities been detrimentally impacted by past activity?

- ❑ Yes
- ❑ No
- ❑ Don't know *(go to "7.4")*

If yes, by how much: ❑ Highly affected
❑ Moderately affected
❑ Minimally affected

Have the wetland hydrological characteristics been detrimentally affected by other nearby activities?

- ❑ Yes
- ❑ No
- ❑ Don't know *(go to "7.4")*

If yes, by how much:
- ❑ Highly affected
- ❑ Moderately affected
- ❑ Minimally affected

b. Potential Rehabilitation/Restoration

Can the wetland be rehabilitated/restored?

- ❑ Likely
- ❑ Unlikely
- ❑ Very unlikely

At what cost?

- ❑ Very costly
- ❑ Costly
- ❑ Not very costly

c. Wetland Status

This item relates to the degree to which the cumulative impacts have passed an acceptable threshold level, and the wetland is beyond restorative assistance. Wetlands that are considered "lost" do not warrant further consideration unless they represent one of the last wetlands of their type in the region.

Has the wetland been compromised up to or beyond its viability as a functioning wetland?

- ❑ Yes *(if yes, then complete next question)*
- ❑ No *(if no, go to Stage One (see Section 7.4))*

Have most similar wetland types been lost to conversion in the region?

- ❑ Yes *(if yes, go to "d. Recommendation" and consider (1) and (2))*
- ❑ No *(if no, go to "d. Recommendation" and consider (3) and (4))*

d. Recommendation

- ❑ (1) Protect wetland as a representative or unique example.
- ❑ (2) Consider restoration/rehabilitation of wetland.
- ❑ (3) Consider proceeding with development if cumulative impacts on wetlands are already high.
- ❑ (4) Proceed to Section 7.4, Stage One.

If recommendation 1, 2 or 3 accepted, stop evaluation here.

Evaluator's Signature _____ Date _____

CONCLUSION OF CUMULATIVE IMPACT ASSESSMENT

Name of Wetland _____

Name *Area/Town/Province/Territory*

Complete this evaluation in a sequential manner. Potential sources of information are listed in Appendix C.

7.4 Stage One *"General Analysis"*

The "General Analysis" is designed to provide land use planners, administrators, developers, and the public with an opportunity to examine the relative value of wetlands, and any proposed projects which may directly or indirectly impact those wetland values (Figure 7.1). This "General Analysis" sets out a process of easily identifying - from readily available public data - biological, hydrological and biogeochemical, social/cultural, and production wetland functions and the expected new production functions generated by the proposed project. All considerations are at an international, national, or provincial level of significance. A few are also at a regional scale of consideration.

Comparing the importance of the wetland and the project, provides the evaluator with knowledge about the desirability of: (1) protecting the wetland because it has outstanding value; (2) approving the project because it has outstanding value and the wetland has little or no value; and (3) deferring to Stage Two because no conclusion is obvious. The ratings provide guidance only to the recommendations.

Note: When listing sources, indicate relevant documents, authorities, and agencies.

Stage One Evaluation undertaken by:

Name _____

Address _____

_____

Stage One values are based upon obvious, easily verified findings. Lack of sufficient information or inconclusive results will trigger the Stage Two application. Values allocated are:

H = High Value (3); M = Moderate Value (2); L = Low Value (1); NA = Not Available (X)

Where information is not available or unknown, check additional sources. If still unavailable or unknown, then automatically proceed to Stage Two (Section 7.5).

7.4.1 Biological Component: Importance to Wildlife/Plant Communities

Potential Source of Data:
- Territorial/Provincial Wildlife or Natural Resources Agency
- University/Community College, Botany and Biology Departments
- Canadian Wildlife Service/Wildlife Habitat Canada office
- Local Ducks Unlimited Canada office
- Canada Land Inventory (Agriculture Canada)

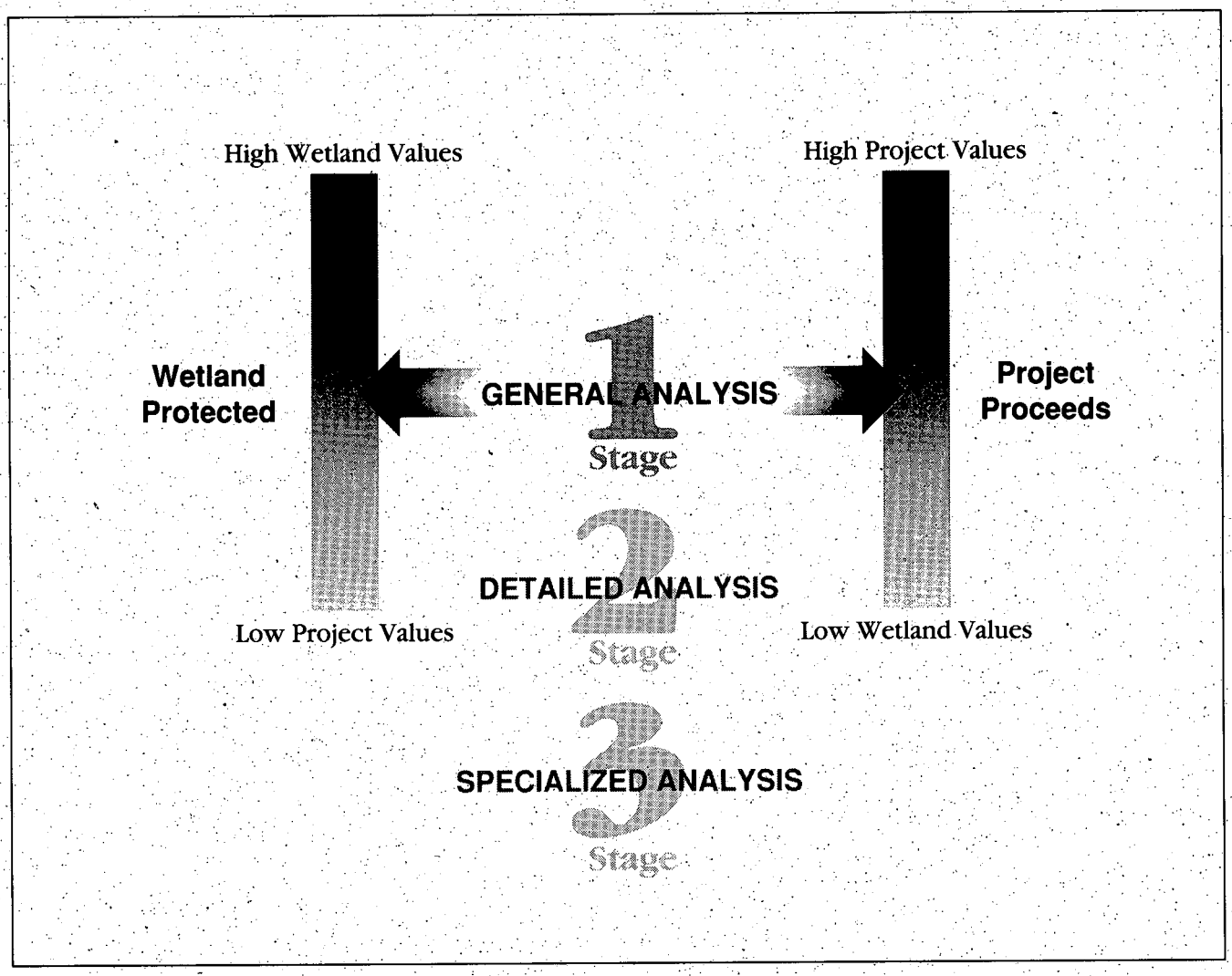


Figure 7.1 Stage One: General Analysis

i. Significance for Waterfowl/Wildlife Species

This relates to the importance, at a national or provincial scale of significance, of the wetland as a habitat for the production, migration or other life history events for waterfowl and other animal species at a national or provincial scale of significance. *(Select most current classification, and circle numbers in either the Canada Land Inventory box OR the Provincial/Territorial Classification box. Enter circled numbers on the lines beside each column and their sum on the subtotal line).*

CANADA LAND INVENTORY

	HIGH (Class 1-2)	MODERATE (Class 3-4)	LOW (Class 5-7)	NOT AVAILABLE	
Waterfowl	3	2	1	x	_____
Wildlife	3	2	1	x	_____

Subtotal *(maximum is 6)* _____
(where "x" occurs, go to "7.5")

Or

PROVINCIAL/TERRITORIAL CLASSIFICATION

	HIGH	MODERATE	LOW	NOT AVAILABLE	
Waterfowl	3	2	1	x	_____
Wildlife	3	2	1	x	_____

Subtotal *(maximum is 6)* _____
(where "x" occurs, go to "7.5")

Source _____

_____

ii. Rarity/Scarcity or Uniqueness

This relates to the degree to which the wildlife and vegetation species and populations inhabiting the wetland are rare, endangered or vulnerable within the region. *(circle numbers and total them)*

NATIONAL, OR PROVINCIAL/ TERRITORIAL CLASSIFICATION

	HIGH	MODERATE	LOW	NOT AVAILABLE	
Waterfowl/Wildlife	3	2	1	x	_____
Vegetation	3	2	1	x	_____

Subtotal *(maximum is 6)* _____
(where "x" occurs, go to "7.5")

Source _____

_____

Total Biological Component Rating: ☐ *(maximum is 12)*

(add "i." + "ii." subtotals, transfer total to equation in "7.4.6")

7.4.2 Hydrological Component: Water Quality/Groundwater/Erosion Control/Flood Control

This relates to the importance of the wetland for valued hydrological functions. It may be a general rating based on interviews with water analysts.

Source of Data: ▪ Territorial/Provincial/Federal Water Resources Agencies

(circle numbers and total them)

	HIGH	MODERATE	LOW	NOT AVAILABLE	
Significance of Contribution to Provincial Regional Water Quality/Groundwater	3	2	1	x	
Significance of Contribution to Provincial/Regional Erosion Control/Flood Control	3	2	1	x	

Total Hydrological Rating *(maximum is 6)* _____

(transfer total to "7.4.6"; where "x" occurs, go to Stage Two ("7.5"))

Source _____

_____

7.4.3. Social/Cultural Component: Contribution to Quality of Life

This relates to the existing public commitment to the wetland as exemplified by way of current legislated actions that protect significant wetland resources.

Sources of Data: ▪ Territorial/Provincial Lands Branch
▪ Territorial/Provincial Planning Branch
▪ Territorial/Provincial Environment Branch

(circle numbers and total them)

	HIGH	MODERATE	LOW	
Existing, Proposed or Potential International/National/Provincial/Regional Heritage Designation or Protected Status (within or adjacent to the protected area)	3	2	1	

Total Social/Cultural Rating *(maximum is 3)* _____

(transfer total to "7.4.6")

Source _____

_____

7.4.4 Production Component: Expected New Project Production Benefits

This relates to the potential new added value production benefits which may result from implementation of the project, both geographically and within the economic sectors.

Sources of Data:
- The proponent
- Territorial/Provincial Economic Development Agency
- Municipal/Regional Economic Development Office

(circle numbers and total them)

	HIGH	MODERATE	LOW	
Significance to the Economic Sector (e.g. agriculture, forestry or tourism)	3	2	1	____
Economic Significance to National, Provincial, Regional Development and Employment	3	2	1	____

Total Production Component Rating *(maximum is 6)* ____
(transfer total to "7.4.6")

Source _____

_____

7.4.5 Copy of All Relevant Findings and Sources Attached

- ❑ Yes
- ❑ No

If no, then list _____

_____

_____

_____

_____

_____

_____

Describe other major issues relevant to a decision _____

_____

_____

_____

_____

_____

_____

_____

7.4.6 Overall Project Impact Rating

An overall project rating occurs when the preceding Sections (7.4.1 - 7.4.4) are examined to compare the overall significance of the wetland to that of the proposed project. This significance is identified in the rating calculation which follows.

a. Rating Calculation

(insert totals from previous Sections (7.4.1 - 7.4.4) in boxes provided, subtract total in Section 7.4.4 from total of 7.4.1 to 7.4.3, and calculate overall rating)

CURRENT WETLAND STATUS

7.4.1 Biological Rating		(a)
7.4.2 Hydrological Rating		(b)
7.4.3 Social/Cultural Rating		(c)

PROJECT STATUS

7.4.4 Projected Production Change Rating		(d)

Overall Rating = _____ (e)
a+b+c minus d = e

NOTE: When a value of "U" (unknown) or "NA" (not available) occurs, then proceed to either gather that information or move directly to Stage Two "7.5" to address that requirement.

b. Overall Rating

The equation totals the three wetland function component values (a + b + c) and subtracts the new project production benefits value (d). The result is an overall rating (e) which represents the value of the wetland in relation to the benefits of the proposed project.

- Maximum possible value: 19
- Minimum possible value: 1
- Where overall rating is equal to or greater than 13, project rejection (or relocation) should be recommended.
- Where overall rating is equal to or less than 3, project approval should be recommended.
- Where overall rating is between 4 and 12 inclusive, project should be referred to Section 7.5, Stage Two.

Instructions to Evaluators

This overall rating provides guidance only to the recommendation, but other factors such as critical thresholds on particular wetland functions or the role of a single wetland within a broader wetland complex (e.g. prairie potholes) should be considered and noted in the recommendation. Despite the overall rating, the evaluator would also have the option of concluding that the significance of *one* wetland or project component is so overwhelming, e.g. habitat to endangered species, key source of groundwater, Canada Land Inventory or provincial class I rating, designation as a national or provincial park, etc.) that the recommendation of rejecting the project is warranted on this basis alone. A strong justification is required.

7.4.7 Recommendation

- ❑ (a) reject project
- ❑ (b) refer to Stage Two "7.5"
- ❑ (c) approve without conditions
- ❑ (d) approve with conditions

(list necessary mitigative measures and measures to retain/enhance wetland functions of value to society in (e))

(e) mitigative measures _____

_____

_____

_____

_____

(f) reasons for recommendation *(note: outline by project benefits and important wetland functions/values lost or reduced do not simply report the number calculated)* _____

_____

_____

_____

_____

_____ _____

Evaluator's Signature Date

If referred to "7.5", outline particular project impacts or wetland functions/values that may be worthy of special attention _____

_____

_____

_____

_____

CONCLUSION OF STAGE ONE "GENERAL ANALYSIS"

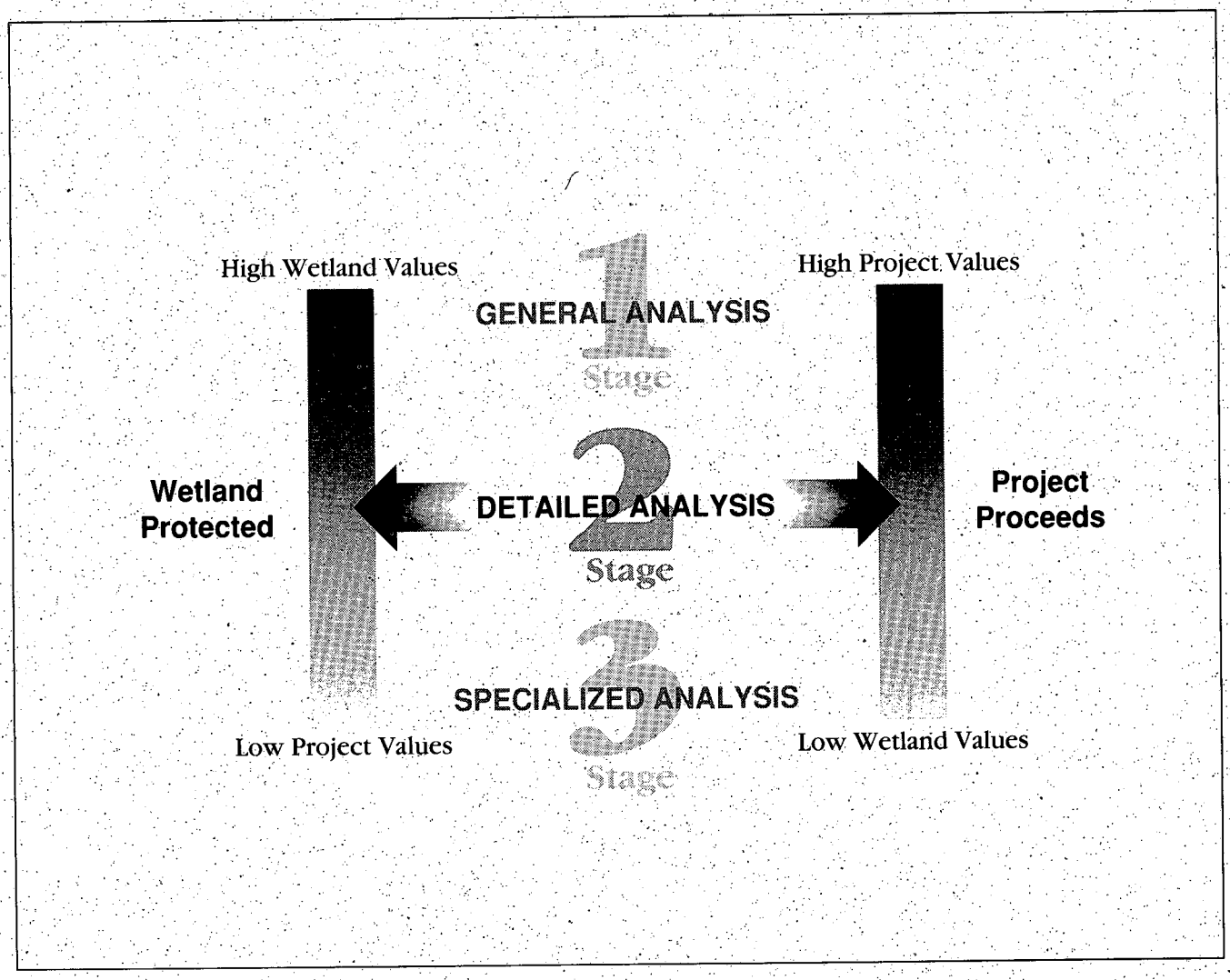


Figure 7.2 Stage Two: Detailed Analysis

7.5 Stage Two *"Detailed Analysis"*

This involves the application of a multiple value evaluation matrix.

7.5.1 Purpose of Stage Two

To identify all functions of the particular wetland that are of value to society, to determine which of these values would be significantly disrupted or impaired by the proposed development, and to allow decision makers to examine the wetland and project values and make explicit trade-offs.

Research has shown that multiple objectives can be reasonably established and evaluated to provide a detailed picture about resource values and their importance and susceptibility to impact. Stage Two, *Detailed Analysis*, utilizes a multiple value evaluation by listing the biological, hydrological and biogeochemical, social/cultural and market and non-market economic production values of wetlands; hence the term "multiple value matrix". It also lists project production values.

At this stage, existing known (primary and secondary) sources of data will form the basis for multiple value evaluation. Detailed production assessments will be left for Stage Three, *Specialized Analysis*. Therefore, new primary data will not be generated except in unique situations where such data can be readily developed and is essential to this stage, for instance where initial required information is unknown but easily obtained. Site visits may be useful to record photographs of the site, note site features and possibly address additional information requirements. While the Stage Two process is somewhat subjective and open to interpretation, in terms of its reliance upon secondary sources, it should nevertheless be a rigorous process based upon substantiated findings. It will generate an order of magnitude of significance of both wetland and project values and level of impact upon wetland functions.

Stage Two is divided into six steps: Steps one to five complete the multiple value wetland evaluation matrix and summary of wetland and project status, and Step six recommends a course of action: project approval, rejection, approval with conditions or referral to Stage Three, *Specialized Analysis* (Section 7.6).

Stage Two Evaluation Undertaken By:

Name _____

Position/Title _____

Organization _____

Address _____

_____

Instructions to Evaluators

Stage Two can be completed by non-professionals if the evaluator is prepared to take time to ask questions of professionals, record answers, and be systematic.

This stage has been developed to assist decision makers to better understand the rationale behind recommendations to approve projects or protect wetlands.

Evaluators should not be discouraged by the length of Stage Two. Evaluators need to remember that wetlands frequently have subtle but dramatic influences upon a variety of societal values and needs. Only recently has such recognition been acknowledged in the decision-making process.

Stage Two "Detailed Analysis" has been organized into a matrix using a numerical and simple answer format. While such a process permits evaluation of multiple values, it does not provide for substantive analysis. So... be thorough, be diligent and be systematic. You will be contributing to better decisions!

Evaluators should ensure that decision makers understand the rationale for recommendations.

There are six steps to the Stage Two Multiple Value Wetland Evaluation Process. These are:

1) Wetland Values Analysis
2) Summary of Wetland Values, Significance and Expected Impact
3) Project Benefits Analysis
4) Summary of Project Benefits, Significance and Expected Impact
5) Overall Summary of Wetland and Project: Key Benefits and Disbenefits
6) Recommendations

Sources of Information

If proceeding to Stage Two, please refer to Appendix C, "General Sources of Information", to help with your evaluation.

7.5.2 Multiple Value Wetland Evaluation Matrix

The next few sections describe the action to be taken in Step 1.

Wetland Values – Column 2.1.A

- represent the key function types that may occur in the wetland under review.
- these values follow the discussion in Section 4.

Evaluation Criteria – Column 2.1.B

- individual values that are worthy of evaluation for all wetlands.

Are Criteria Present? – Column 2.1.C

- identifies the level of knowledge concerning criteria occurrence. Note: if occurrence is unknown, seek other information sources until occurrence can be substantiated.

Level of Criterion Significance – Column 2.1.D

- measures the relative significance of each criterion in terms of value as a biological, hydrolgical, biogeochemical, and social/cultural wetland benefit.

Expected Impact of Project Upon Wetland Values – Column 2.1.E

- measures the expected effect of the project upon actual and potential wetland values.

Critical Values: These are identified with an asterisk (*) and are noted for some of the wetland criteria under the "present" column. Critical value notation indicates a wetland value whose product, service or function is very important to society or where an important threshold or function may be exceeded, resulting in the loss of the function and value. These values should not be detrimentally impacted by a project. Such detrimental impact could lead to irreparable or significant effect(s) upon society's well-being.

The evaluator is strongly urged to perform the investigation and research necessary to fill in the answers and ratings to the maximum extent possible for all of the critical values.

7.5.2 (cont.) Step 1 of Stage Two *"Detailed Analysis"*: Wetland Values Analysis

In each of the charts that follow over the remaining pages of Section 7, the columns will be headed "Yes", "Likely", and "Possibly", etc. To ensure consistent understanding and use of these terms by all evaluators you are requested to apply the following definitions to these terms.

"Yes" means a ***confirmed presence***. Proceed to 2.1.D.

"Likely" means that ***data suggests the presence but that the presence is unconfirmed***. Proceed to 2.1.D.

"Possibly" means that ***location and circumstance suggests presence but that no data are available***. Proceed to 2.1.D.

The following wetland values are selected for application in all wetland evaluation situations. The evaluator is asked to check off (✓) the individual findings and to provide a numerical total of all occurrences under each heading. Where a criterion is not present, the evaluator should check off "no" or "unknown" in column 2.1.C and write "not present" under column 2.1.F and the obvious reason for absence. Note: To determine critical values total, only add values for questions marked with an asterisk*.

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

1. Life-support Values

▪ *Relate to the capacity of the wetland to regulate and maintain essential ecological processes and life-support systems that have value to society.*

1.1 Hydrological Values

▪ *Value of the wetland in contributing to surface and groundwater stocks.*

* 1.1.1 Does the wetland contribute to recharge of regional water supply aquifers?

* 1.1.2 Does the wetland provide flood protection benefits?

1.1.3 Does the wetland contibute to usable surface water?

1.1.4 Does the wetland provide erosion control?

1.1.5 Does the wetland provide flow augmentation to users through a headwater position in the catchment basin?

* 1.1.6 Does the wetland reduce tidal impacts?

Hydrological Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES (Continue to 2.1.D)	LIKELY (Continue to 2.1.D)	POSSIBLY (Continue to 2.1.D)	NO (Return to 2.1.B next criterion)	UNKNOWN (Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)	Source

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

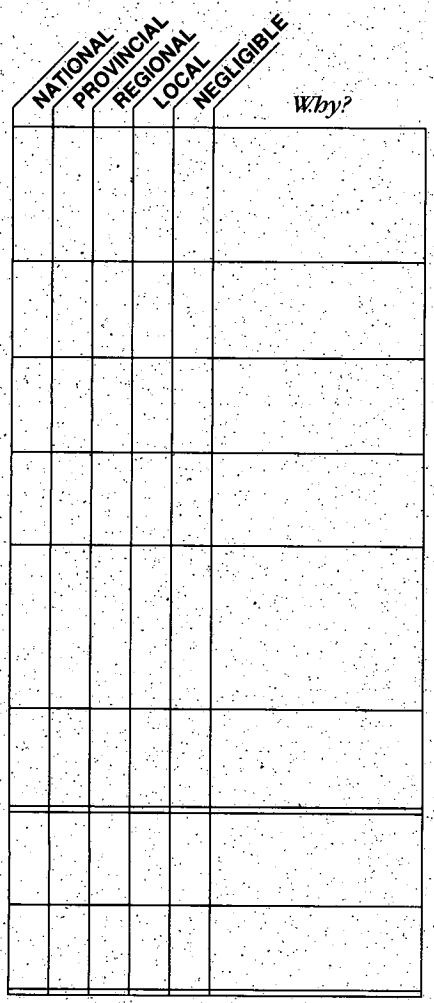
2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

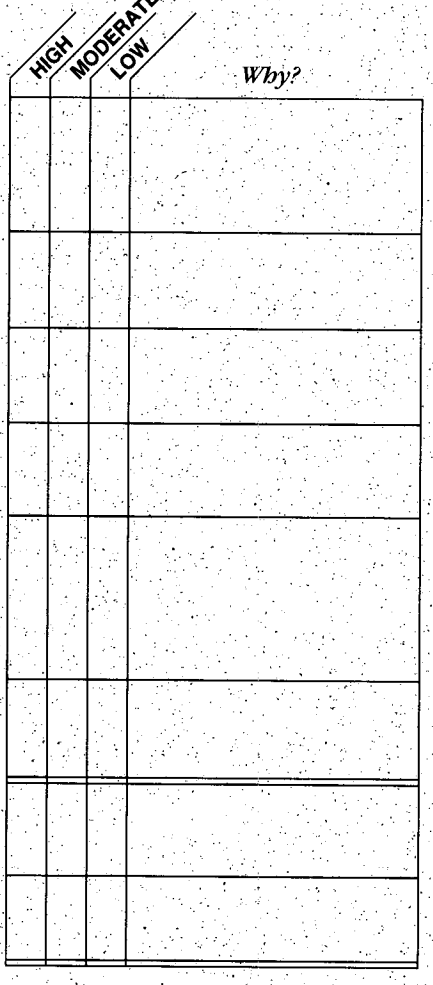
2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE:

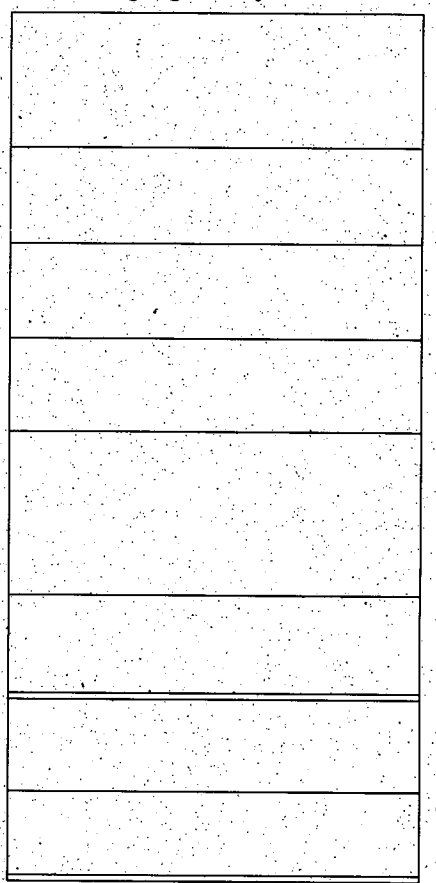


2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES:



2.1.F
DESCRIBE FUNCTION:

Provide highlights only



2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

1. Life-support Values

1.2 Biogeochemical Values

▪ *Value of the wetland in contributing to surface water and groundwater quality.*

* 1.2.1 Does the wetland receive significant pollution of a type amenable to amelioration by wetlands?

1.2.2 Does the wetland provide storage for agricultural run-off?

* 1.2.3 Does the wetland provide for containment of toxics contained in surface run-off or through discharge flow?

1.2.4 Does the wetland provide for sediment flow stabilization?

1.2.5 Does the wetland have high nutrient levels which support significant wildlife populations?

Biogeochemical Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	Source

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES

HIGH	MODERATE	LOW	*Why?*

2.1.F
DESCRIBE FUNCTION

Provide highlights only

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

1. Life–support Values

1.3 Habitat Values

▪ *Role of the wetland in contributing to the well-being of important plant and animal values.*

	YES (Continue to 2.1.D)	LIKELY (Continue to 2.1.D)	POSSIBLY (Continue to 2.1.D)	NO (Return to 2.1.B next criterion)	UNKNOWN (Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)	Source
* 1.3.1 Are there any rare, threatened or endangered animal or plant species present?						
* 1.3.2 Does the wetland contain high quality significant habitats for migratory birds?						
1.3.3 Does the wetland provide habitat for sport and/or commercial fish?						
1.3.4 Does the wetland provide significant habitat for reptiles and amphibians?						
1.3.5 Does the wetland provide significant habitat for crustaceans?						
1.3.6 Does the wetland provide significant habitat for mammals?						
* 1.3.7 Does the wetland support a significant animal or plant species in unusual abundance?						
1.3.8 Does the wetland and its associated vegetation protect natural shorelines?						
* 1.3.9 Is the wetland ranked as a Class I, II or III wetland by Canada Land Inventory or other accepted evaluation systems?						
Habitat Values Total *(add check marks and enter the numerical total)*						
**** Critical Values Total*** *(add check marks and enter the numerical total)*						

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D LEVEL OF CRITERION SIGNIFICANCE						2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES			2.1.F DESCRIBE FUNCTION
NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*	HIGH	MODERATE	LOW	*Why?*	*Provide highlights only*

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

1. Life-support Values

1.4 Ecological Values

▪ *Role of the wetland in stimulating relations of plant and animal communities.*

1.4.1 Does the wetland support an extensive ecosystem complex including uplands?

* 1.4.2 Has a regional threshold been reached where the significance of wetland ecosystems for the entire region will be compromised by further degradation?

* 1.4.3 Is the wetland considered a classic example of its type?

1.4.4 Are there few remaining natural, unimpacted wetlands of this type in the region?

1.4.5 Does the wetland contain, owe its existence to, or is it a part of or ecologically associated with, a geological feature which is an excellent representation of its type?

1.4.6 Does the wetland form an integral part of an important water drainage system?

* 1.4.7 Does the wetland display biological diversity that is of interest?

Ecological Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	Source

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES

HIGH	MODERATE	LOW	*Why?*

2.1.F
DESCRIBE FUNCTION

Provide highlights only

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

2. Social/Cultural Values

2.1 Aesthetic Values

▪ *Role of the wetland in the quality of the scenic environment.*

2.1.1 Is the wetland visible from a provincial/territorial highway, a designated scenic highway/road or passenger railroad?

2.1.2 Does the wetland provide a valuable aesthetic or open space function?

2.1.3 Does the wetland add substantially to the visual diversity of the landscape ?

* 2.1.4 Is the wetland an important sightseeing locale?

Aesthetic Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	*Source*

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES

HIGH	MODERATE	LOW	*Why?*

2.1.F
DESCRIBE FUNCTION

Provide highlights only

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

2. Social/Cultural Values

2.2 Recreational Values

▪ *Role of the wetland in stimulating recreation activities.*

2.2.1 Does the wetland provide a base for viewing or photographing large numbers of wildlife?

2.2.2 Does the wetland provide opportunities for boating?

2.2.3 Does the wetland provide winter recreation opportunities?

2.2.4 Does the wetland provide high quality sport hunting or fishing?

Recreational Values Total

(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	*Source*

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types.

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES

HIGH	MODERATE	LOW	*Why?*

2.1.F
DESCRIBE FUNCTION

Provide highlights only

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

2. *Social/Cultural Values*

2.3 Education and Public Awareness Values

▪ *Role of the wetland in stimulating public values and understanding.*

2.3.1 Is the wetland used for scientific research?

* 2.3.2 Is the wetland used for educational and interpretation purposes?

2.3.3 Does the wetland exist close to a large urban population?

2.3.4 Does the wetland receive large numbers of visitors?

Education and Public Awareness Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	Source

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

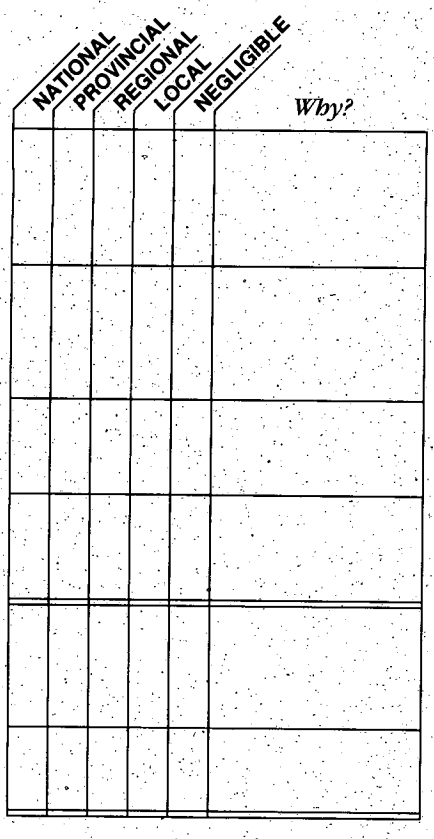
2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

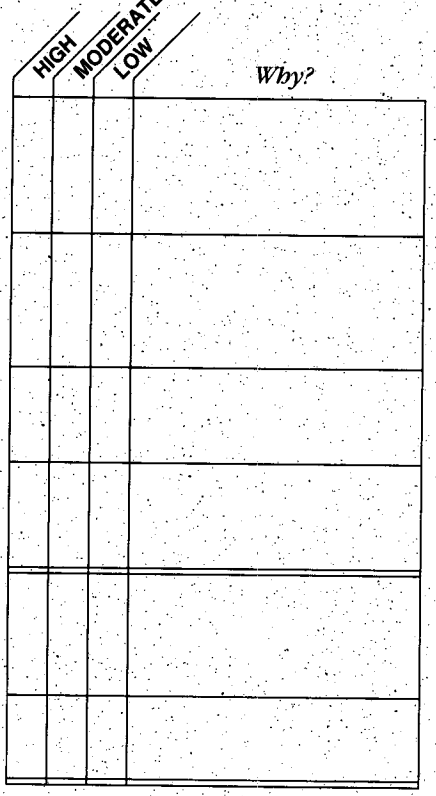
2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

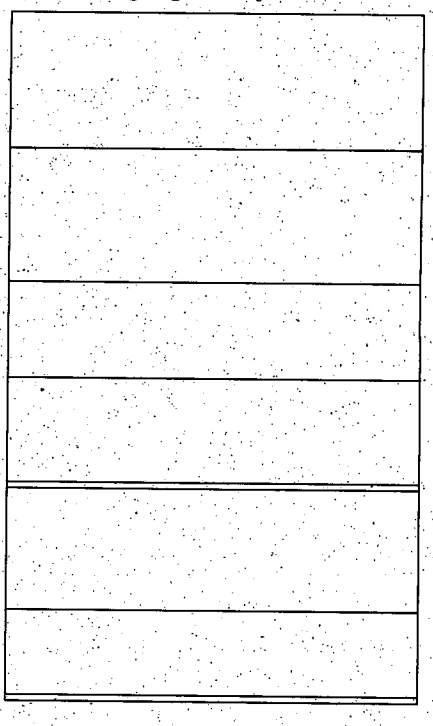
2.1.D
LEVEL OF CRITERION SIGNIFICANCE



2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES



2.1.F
DESCRIBE FUNCTION



2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

2. Social/Cultural Values

2.4 Public Status Values

▪ *Role of the wetland in creating a sense of public ownership.*

	YES (Continue to 2.1.D)	LIKELY (Continue to 2.1.D)	POSSIBLY (Continue to 2.1.D)	NO (Return to 2.1.B next criterion)	UNKNOWN (Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)	Source
2.4.1 Is the wetland part of the pattern of settlement and rural/urban lifestyle?						
2.4.2 Is the wetland a designated site of special public interest?						
* 2.4.3 Is the wetland a unique national, provincial or regional resource?						
2.4.4 Are there policies/programs to support conservation/restoration of the wetland?						
2.4.5 Does the wetland provide for easy public access?						
2.4.6 Is the wetland public land?						
Public Status Values Total *(add check marks and enter the numerical total)*						
**** Critical Values Total*** *(add check marks and enter the numerical total)*						

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

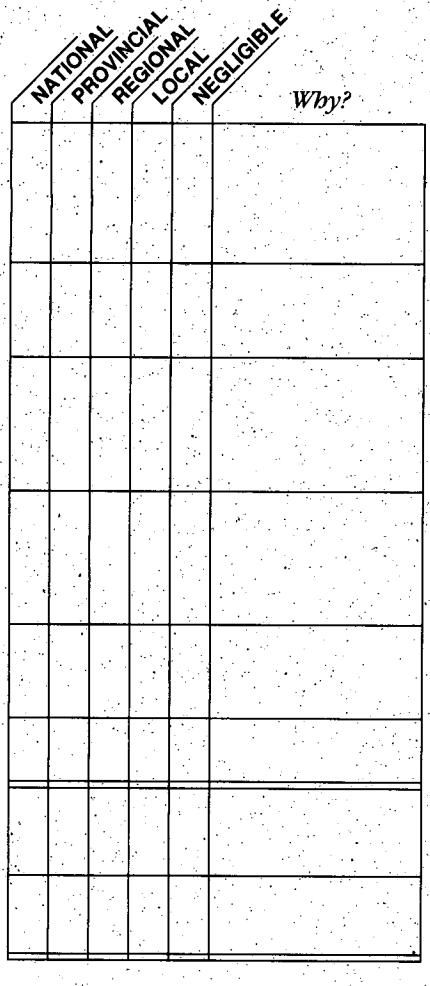
2.1.B EVALUATION CRITERIA - an indication of critical values

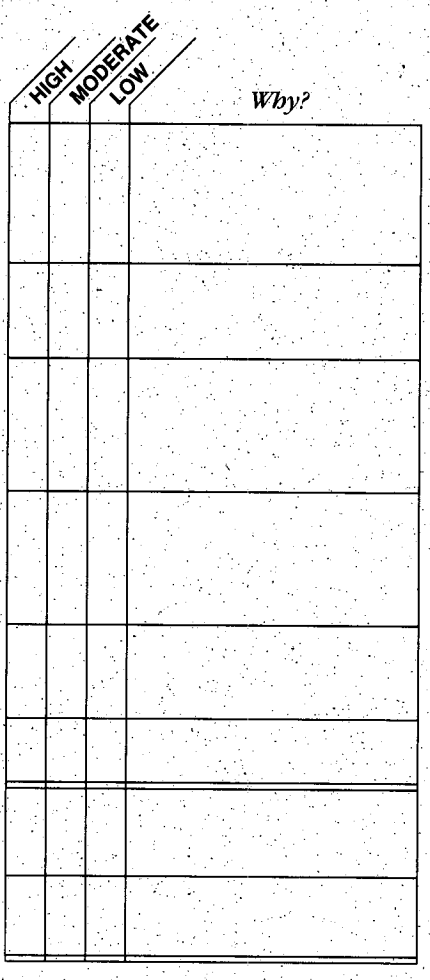
2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

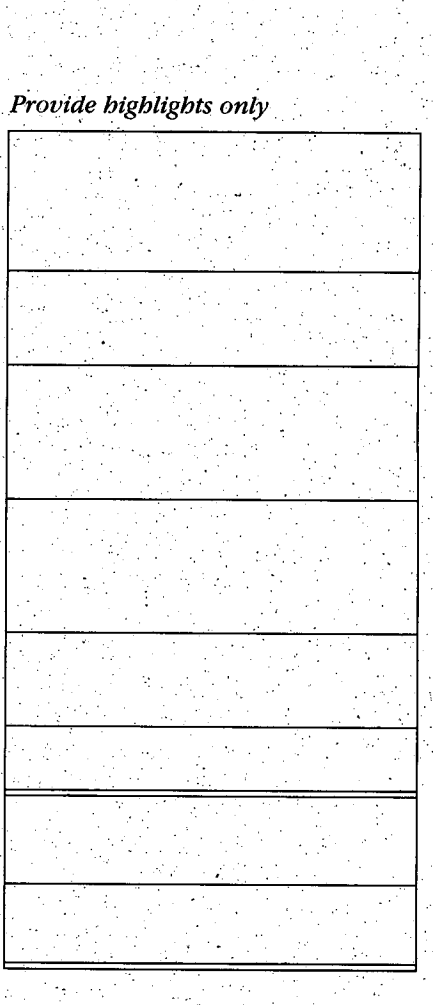
2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D LEVEL OF CRITERION SIGNIFICANCE	2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES	2.1.F DESCRIBE FUNCTION







2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

2. Social/Cultural Values

2.5 Cultural Attribute Values

▪ *Role of the wetland in the identity of the people in the area.*

	YES (Continue to 2.1.D)	LIKELY (Continue to 2.1.D)	POSSIBLY (Continue to 2.1.D)	NO (Return to 2.1.B next criterion)	UNKNOWN (Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)	Source
2.5.1 Does the wetland form part of the historical/cultural heritage of a regional population?						
* 2.5.2 Does the wetland contain archaeological or paleontological resources?						
2.5.3 Is the wetland utilised for cultural events or cultural renewal?						
* 2.5.4 Does the wetland form part of a native traditional use area?						
Cultural Attribute Values Total *(add check marks and enter the numerical total)*						
**** Critical Values Total*** *(add check marks and enter the numerical total)*						

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D LEVEL OF CRITERION SIGNIFICANCE						2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES			2.1.F DESCRIBE FUNCTION
NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*	HIGH	MODERATE	LOW	*Why?*	*Provide highlights only*

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

3. Wetland Production Values

3.1 Agricultural Values

▪ *Role of the wetland in contributing to agricultural production.*

	YES (Continue to 2.1.D)	LIKELY (Continue to 2.1.D)	POSSIBLY (Continue to 2.1.D)	NO (Return to 2.1.B next criterion)	UNKNOWN (Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)	Source
3.1.1 Does the wetland provide water for livestock?						
3.1.2 Does the wetland provide a source of forage?						
* 3.1.3 Does the wetland provide a source of water for crop irrigation?						
3.1.4 Does the wetland serve to reduce topsoil erosion?						
3.1.5 Does the wetland serve to increase soil moisture and enhance agricultural crop production?						
Agricultural Values Total *(add check marks and enter the numerical total)*						
**** Critical Values Total*** *(add check marks and enter the numerical total)*						

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D LEVEL OF CRITERION SIGNIFICANCE							2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES				2.1.F DESCRIBE FUNCTION
NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*		HIGH	MODERATE	LOW	*Why?*	*Provide highlights only*

2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

3. Wetland Production Values

3.2 Renewable Resource Values

▪ *Role of the wetland in contributing to the viability of renewable resource harvest.*

* 3.2.1 Is the wetland used for commercial or subsistence hunting, trapping and fishing?

3.2.2 Does the wetland provide opportunities for non-commercial uses of fish, wildlife, crustaceans and/or water resources?

3.2.3 Can forest resources of the wetland be harvested?

* 3.2.4 Are there other commercial uses of the wetland, such as harvesting opportunities for wild rice, cranberries, or gathering crabs and oysters?

Renewable Resource Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	*Source*

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types.

2.1.B EVALUATION CRITERIA - an indication of critical values.

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

2.1.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES

HIGH	MODERATE	LOW	*Why?*

2.1.F
DESCRIBE FUNCTION

Provide highlights only

3. Wetland Production Values

3.3 Non-renewable Resource Values

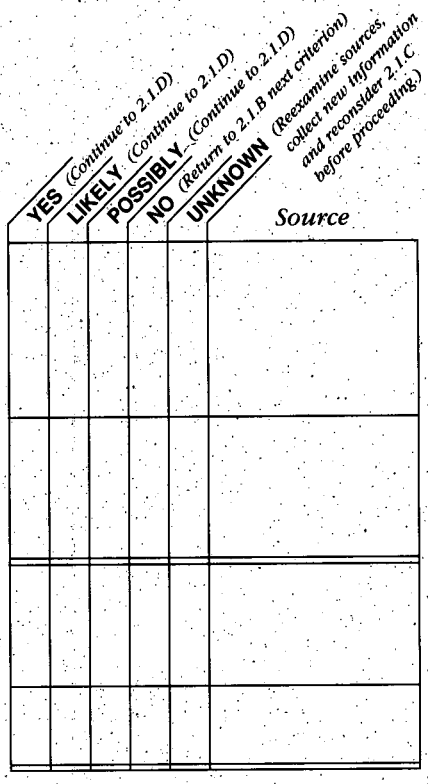
▪ *Role of the wetland in contributing non-renewable resources for consumption.*

* 3.3.1 Is the wetland used as a commercial source of peat for horticulture or energy?

3.3.2 Does the wetland occur over known mineral or gas and oil deposits?

Non-renewable Resource Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)



3.4 Tourism and Recreational Values

▪ *Role of the wetland in stimulating tourism and recreation economic benefits.*

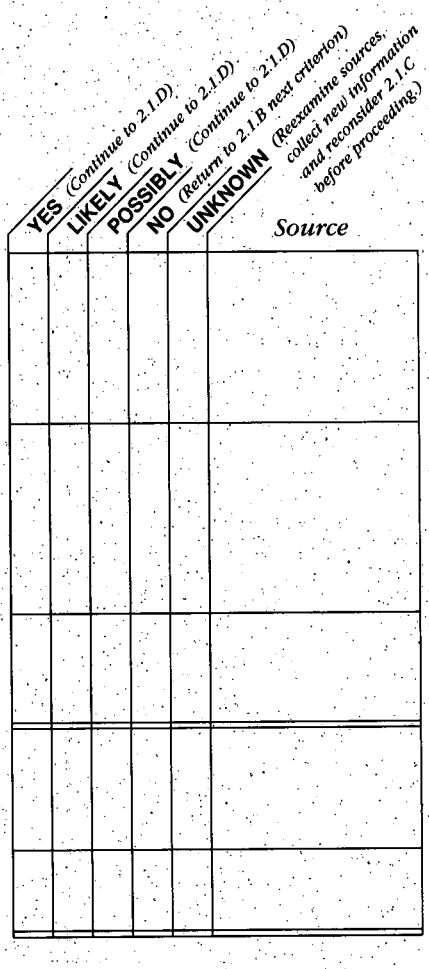
* 3.4.1 Does the wetland represent an important local, regional, or provincial tourism or recreation attraction?

3.4.2 Does the wetland contribute to the local, regional, or provincial tourism and recreation economy?

3.4.3 Does the wetland contribute to national and international tourism development?

Tourism and Recreational Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)



Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

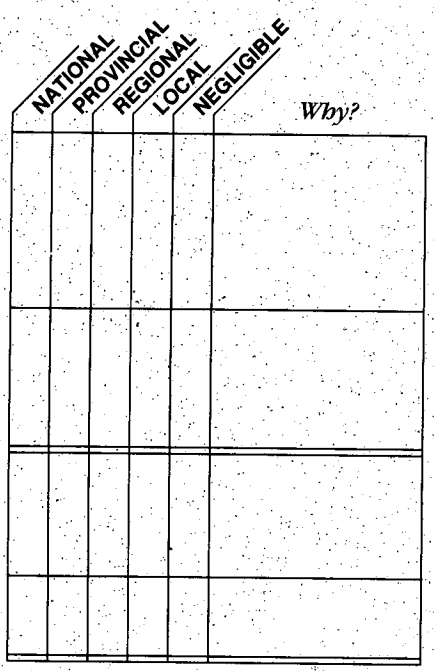
2.1.B EVALUATION CRITERIA - an indication of critical values

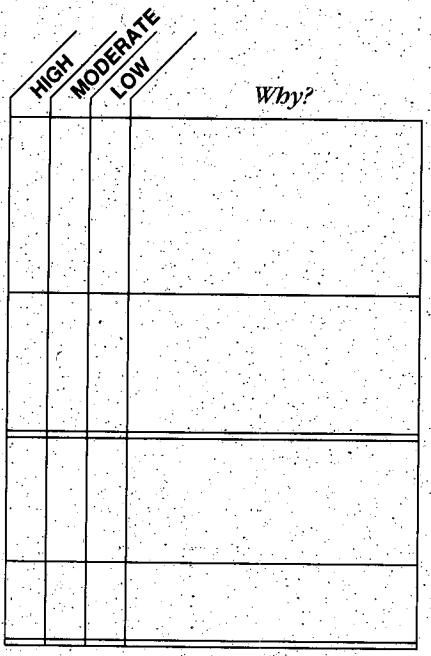
2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

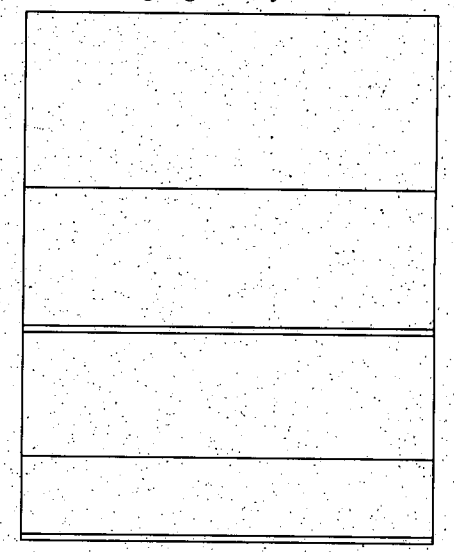
2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

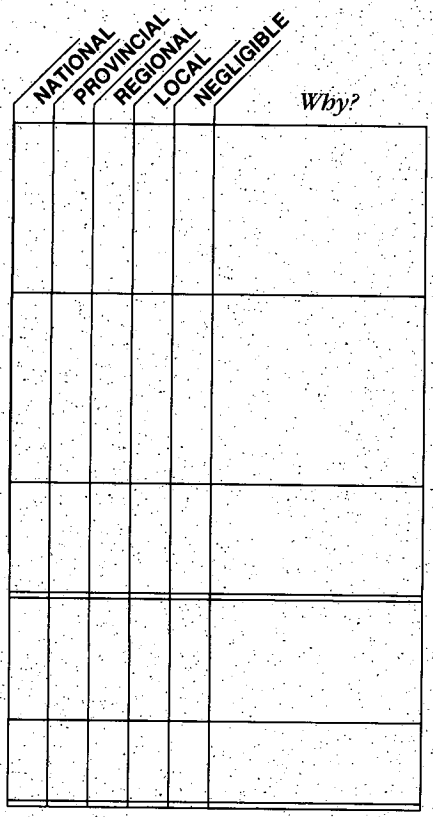
2.1.D LEVEL OF CRITERION SIGNIFICANCE	2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES	2.1.F DESCRIBE FUNCTION

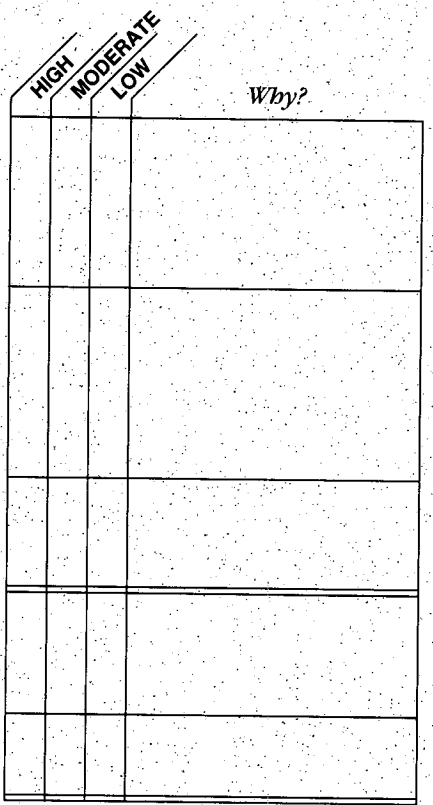




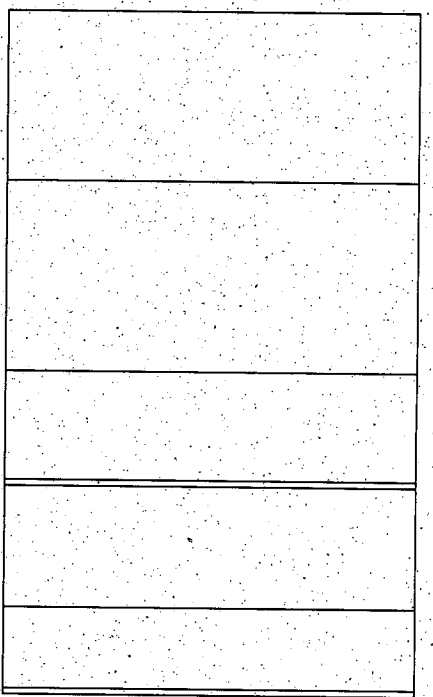
Provide highlights only







Provide highlights only



2.1.A WETLAND VALUES TYPE	2.1.B EVALUATION CRITERIA	2.1.C ARE CRITERIA PRESENT?

3. Wetland Production Values

3.5 Urban Values

▪ *Role of the wetland in contributing to urban economic values.*

* 3.5.1 Is the wetland used to provide water for industry?

* 3.5.2 Is the wetland used as a means of sewage treatment?

* 3.5.3 Is the wetland a direct source of domestic water supply?

3.5.4 Does the wetland enhance residential, commercial or industrial development values?

3.5.5 Does the wetland contribute to urban flood protection and associated land values?

Urban Values Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.1.D)*	LIKELY *(Continue to 2.1.D)*	POSSIBLY *(Continue to 2.1.D)*	NO *(Return to 2.1.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.1.C before proceeding.)*	*Source*

Legend

2.1.A WETLAND VALUES TYPE shows key wetland function types

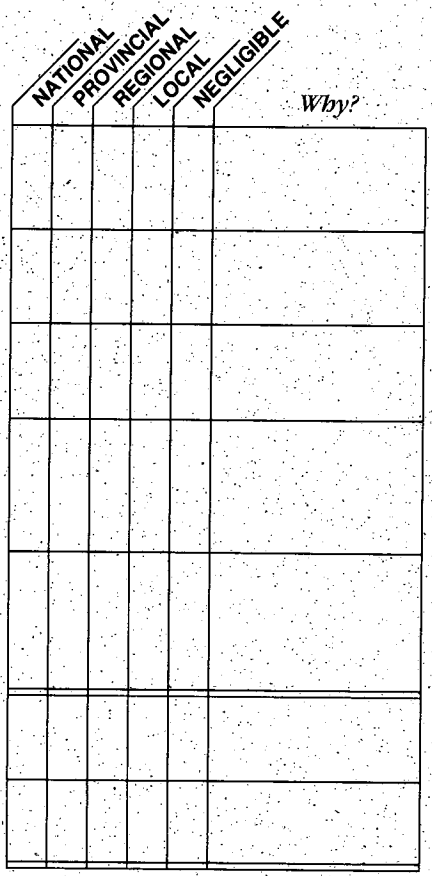
2.1.B EVALUATION CRITERIA - an indication of critical values

2.1.C ARE CRITERIA PRESENT? column to be checked where appropriate

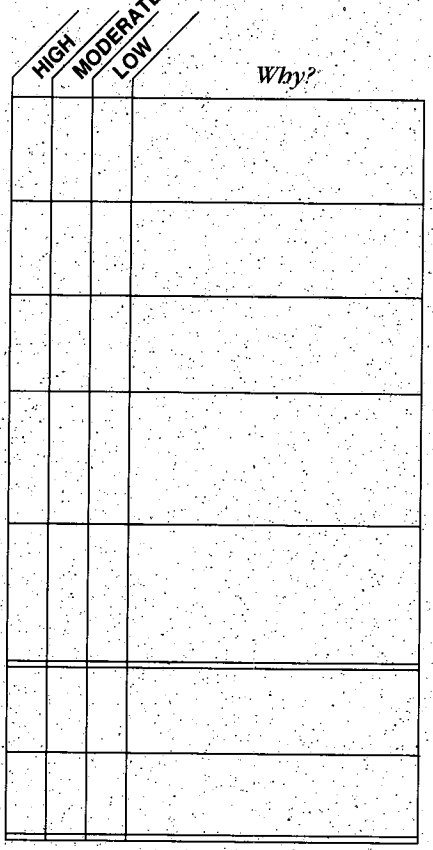
2.1.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.1.E EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES - the estimator's judgement of both actual and potential values

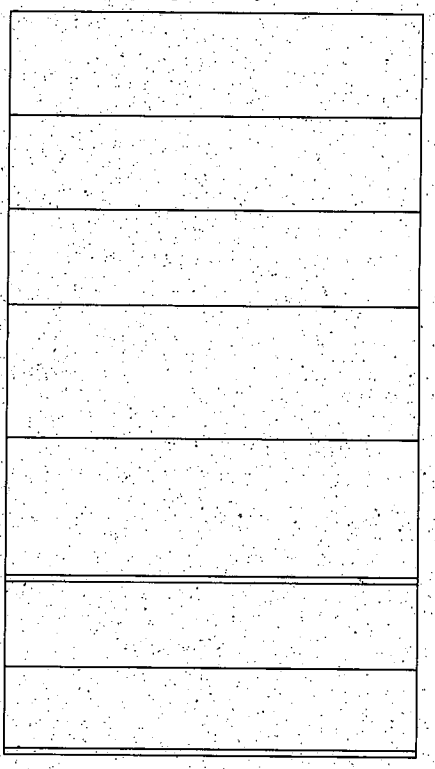
2.1.D
LEVEL OF CRITERION SIGNIFICANCE



2.1.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES



2.1.F
DESCRIBE FUNCTION



7.5.2. (cont.) Step 2 of Stage Two *"Detailed Analysis"*: Summary of Wetland Values, Significance and Expected Impact

- provides a relative rating of the level of occurrence of wetland/project values, their significance and the degree to which they are expected to be impacted by proposed project.
- Step 2 is a summary of Step 1. While numerical summaries are provided, the evaluator should also note in writing the implications of the summary, important wetland values that may be affected by the project, or migrative measures that may be appropriate.
- provides a summary for all wetland values.

(Fill in number of occurrences in each space provided)

2.2.C
ARE CRITERIA PRESENT?

Summary of Wetland Values Significance and Expected Impact

	YES	LIKELY	POSSIBLY	NO	UNKNOWN	CRITICAL *
1. Life–support Values						
1.1 Hydrological Values						
1.2 Biogeochemical Values						
1.3 Habitat Values						
1.4 Ecological Values						
2. Social/Cultural Values						
2.1 Aesthetic Values						
2.2 Recreational Values						
2.3 Education and Public Awareness Values						
2.4 Public Status Values						
2.5 Cultural Attribute Values						
3. Production Values						
3.1 Agricultural Values						
3.2 Renewable Resource Values						
3.3 Non-renewable Resource Values						
3.4 Tourism and Recreational Values						
3.5 Urban Values						
Total Occurrences						

* *(only if listed yes)*

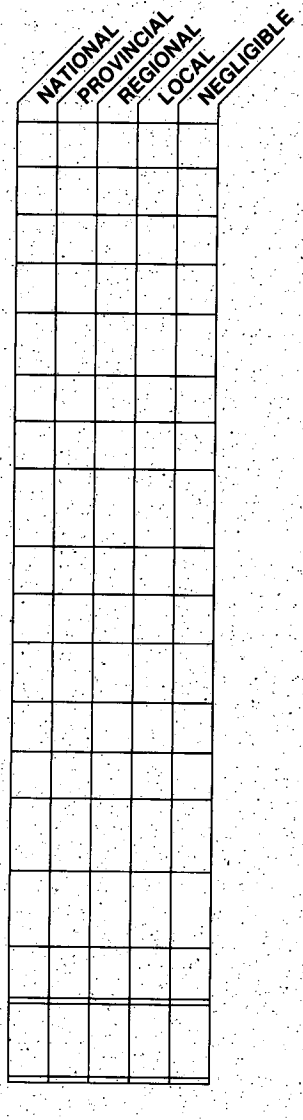
Trigger Factors: *a combination of factors may suggest wetland protection, project acceptance and/or mitigation of project* ***if*** *3 or more critical criteria are marked "yes", criteria are present* ***and/or***

The evaluator should ensure that any relevant information useful to the decision maker should be summarized in the space provided.

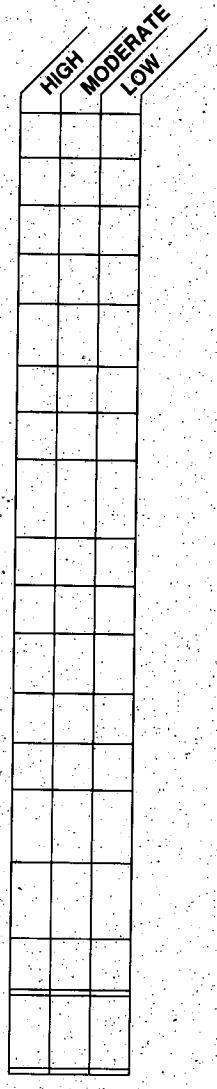
Wherever a trigger factor is noted, the evaluator should determine if a decision should occur at that point.

Note: Generally, fewer nationally significant values are required to denote a nationally significant wetland than those required to denote a locally significant wetland. Also, a combination of several nationally significant values and a large number of regionally significant values could denote a provincially significant wetland. In this summary, reasonable judgement, recognizing the breadth of potential findings, is necessary to provide direction for project acceptance, rejection or referral to Stage Three.

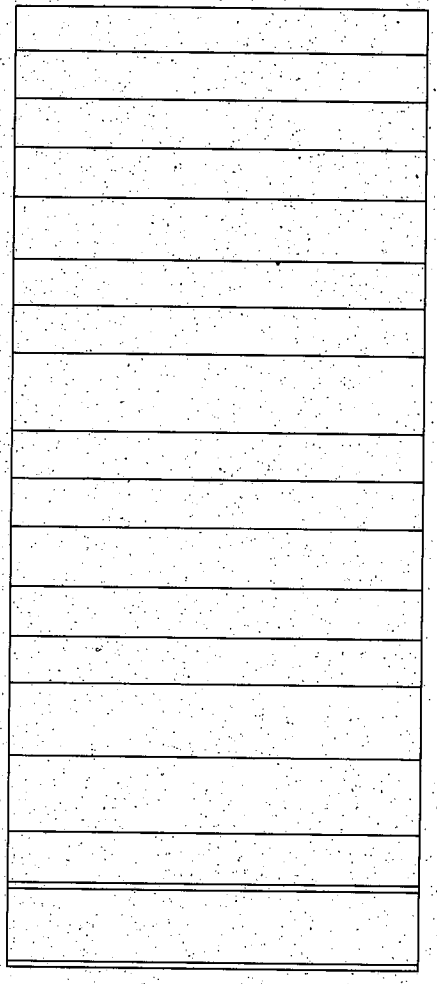
2.2.D
LEVEL OF CRITERION SIGNIFICANCE



2.2.E
EXPECTED IMPACT OF PROJECT UPON WETLAND VALUES



2.2.F
COMMENTS



over 50% of criteria have national/ provincial/ regional significance **and/or** *over one third of expected project impact is high* **then,** *the evaluator should recognize that the wetland has major significance and/or could be significantly affected by the proposed project*

7.5.2 (cont.) Step 3 of Stage Two *"Detailed Analysis"*: Project Benefits Analysis

The next few sections describe the action to be taken in Step 3.

Project Benefits – Column 2.3.A

- represent the key function types that may occur in the proposed project.
- these values follow the discussion in Section 7.4.

Evaluation Criteria – Column 2.3.B

- individual values that are worthy of evaluation for all projects.

Are Criteria Present? – Column 2.3.C

- identifies the level of knowledge concerning criteria occurrence. Note: if occurrence is unknown, seek other information sources until occurrence can be substantiated.

2.3.A PROJECT BENEFITS TYPE	2.3.B EVALUATION CRITERIA	2.3.C ARE CRITERIA PRESENT?

4. Project Benefits

4.1 Employment Benefits

- *Role of the project in stimulating job benefits.*

* 4.1.1 Will the project stimulate new employment opportunities or stabilize existing employment levels in the region?

4.1.2 Will the project provide for high income jobs?

4.1.3 Will the project stimulate employment upgrading?

4.1.4 Will the project stimulate additional research and educational spinoffs?

Employment Benefits Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.3.D)*	LIKELY *(Continue to 2.3.D)*	POSSIBLY *(Continue to 2.3.D)*	NO *(Return to 2.3.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.3.C before proceeding.)*	*Source*

Legend

2.3.A PROJECT BENEFITS TYPE shows the key function types that may occur in the proposed project

2.3.B EVALUATION CRITERIA - an indication of critical values

2.3.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.3.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.3.E EXPECTED IMPACT OF PROJECT UPON ECONOMY - the estimator's judgement of the expected effect of the project upon the economy

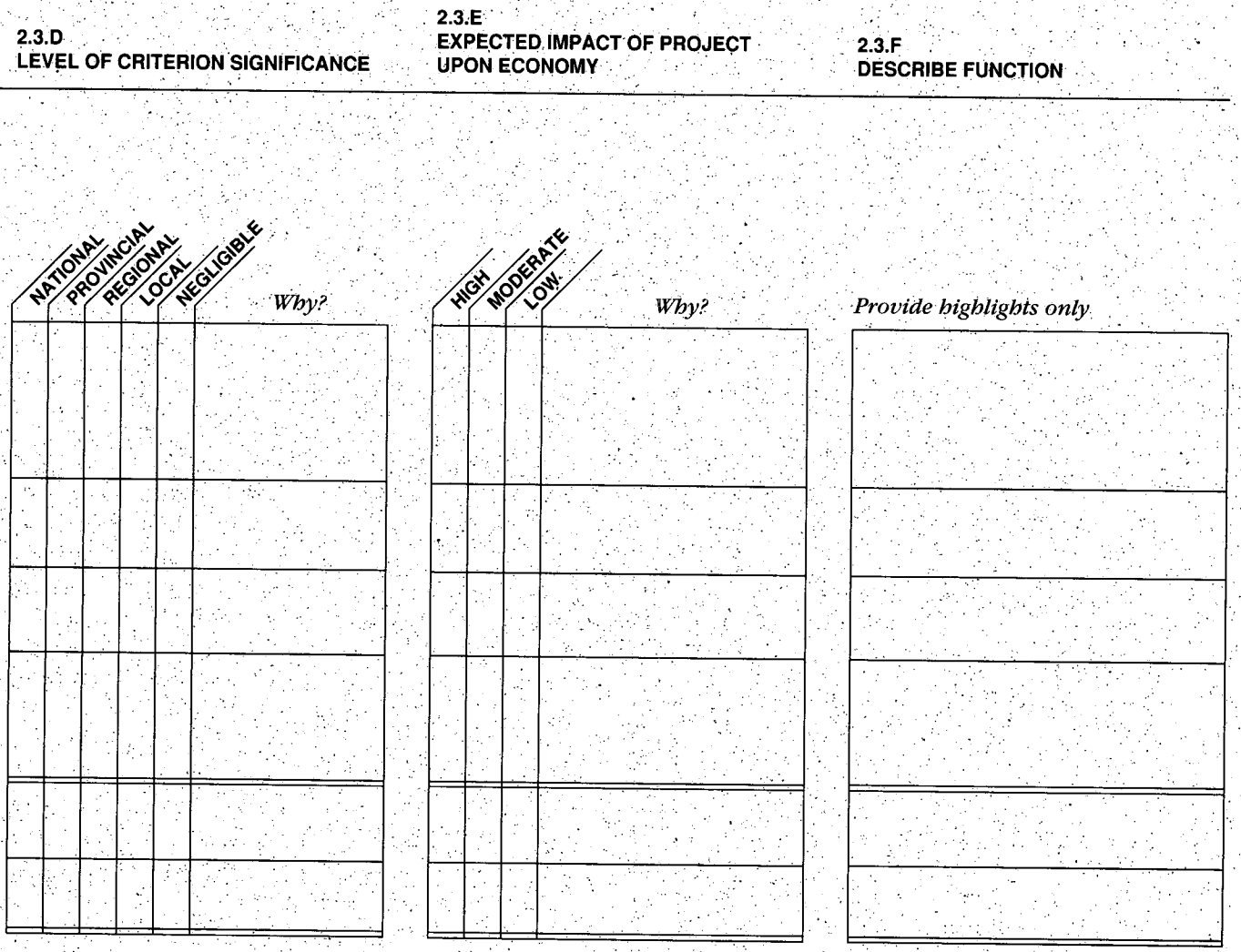
Level of Criterion Significance – Column 2.3.D

- measures the relative significance of each criterion in terms of its production benefits.

Expected Impact of Project Upon Economy – Column 2.3.E

- measures the expected effect of the project upon the economy.

Critical Values: are noted for some of the project criteria under the "present" column. Critical value notation indicates a wetland value whose product, service or function is very important to society or where an important threshold or function may be exceeded, resulting in the loss of the function and value. These values should not be detrimentally impacted by a project. Such detrimental impact could lead to irreparable or significant effect(s) upon society's well-being. Critical Values are identified with an asterisk (*).



2.3.A PROJECT BENEFITS TYPE	2.3.B EVALUATION CRITERIA	2.3.C ARE CRITERIA PRESENT?

4. Project Benefits

4.2 Economic Benefits

▪ *Role of the project in stimulating economic benefits.*

4.2.1 Will the construction of the project stimulate the local and regional economy?

* 4.2.2 Will the operation of the project stimulate the local and regional economy?

4.2.3 Will the operation of the project stimulate value-added production to the provincial or national economy?

4.2.4 Will the project generate significant new taxes and/or enhance the tax base?

Economic Benefits Total
(add check marks and enter the numerical total)

* ***Critical Values Total***
(add check marks and enter the numerical total)

YES *(Continue to 2.3.D)*	LIKELY *(Continue to 2.3.D)*	POSSIBLY *(Continue to 2.3.D)*	NO *(Return to 2.3.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.3.C before proceeding.)*	Source

Legend

2.3.A PROJECT BENEFITS TYPE shows the key function types that may occur in the proposed project

2.3.B EVALUATION CRITERIA - an indication of critical values

2.3.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.3.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.3.E EXPECTED IMPACT OF PROJECT UPON ECONOMY - the estimator's judgement of the expected effect of the project upon the economy

2.3.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.3.E
EXPECTED IMPACT OF PROJECT UPON ECONOMY

HIGH	MODERATE	LOW	*Why?*

2.3.F
DESCRIBE FUNCTION

Provide highlights only

2.3.A PROJECT BENEFITS TYPE	2.3.B EVALUATION CRITERIA	2.3.C ARE CRITERIA PRESENT?

4. Project Benefits

4.3 Production Benefits

- *Role of the project in enhancing training opportunities.*

4.3.1 Will the project stimulate agricultural production?

4.3.2 Will the project stimulate forest production?

4.3.3 Will the project stimulate energy production?

4.3.4 Will the project stimulate tourism and recreational benefits?

4.3.5 Will the project stimulate manufacturing production?

4.3.6 Will the project stimulate other production?

Production Benefits Total
(add check marks and enter the numerical total)

YES *(Continue to 2.3.D)*	LIKELY *(Continue to 2.3.D)*	POSSIBLY *(Continue to 2.3.D)*	NO *(Return to 2.3.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.3.C before proceeding.)*	*Source*

Legend

2.3.A PROJECT BENEFITS TYPE shows the key function types that may occur in the proposed project

2.3.B EVALUATION CRITERIA – an indication of critical values

2.3.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.3.D LEVEL OF CRITERION SIGNIFICANCE – in the estimator's opinion

2.3.E EXPECTED IMPACT OF PROJECT UPON ECONOMY – the estimator's judgement of the expected effect of the project upon the economy

2.3.D LEVEL OF CRITERION SIGNIFICANCE	2.3.E EXPECTED IMPACT OF PROJECT UPON ECONOMY	2.3.F DESCRIBE FUNCTION

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

HIGH	MODERATE	LOW	*Why?*

Provide highlights only

2.3.A PROJECT BENEFITS TYPE	2.3.B EVALUATION CRITERIA	2.3.C ARE CRITERIA PRESENT?

4. Project Benefits

4.4 Urban/Industrial Infrastructure Development

- *Role of the project in enhancing urban/industrial development.*

4.4.1 Will the project provide accommodation and ease housing shortages?

4.4.2 Will the project facilitate a major transport link for the region?

4.4.3 Will the project provide a harbour for the region?

4.4.4 Will the project solve regional waste disposal problems?

4.4.5 Will the project provide an alternate location for infrastructure which is incompatible with the urban built-up area?

Urban/Industrial Infrastructure Development Total
(add check marks and enter the numerical total)

YES *(Continue to 2.3.D)*	LIKELY *(Continue to 2.3.D)*	POSSIBLY *(Continue to 2.3.D)*	NO *(Return to 2.3.B next criterion)*	UNKNOWN *(Reexamine sources, collect new information and reconsider 2.3.C before proceeding.)*	Source

Legend

2.3.A PROJECT BENEFITS TYPE shows the key function types that may occur in the proposed project

2.3.B EVALUATION CRITERIA - an indication of critical values

2.3.C ARE CRITERIA PRESENT? column to be checked where appropriate

2.3.D LEVEL OF CRITERION SIGNIFICANCE - in the estimator's opinion

2.3.E EXPECTED IMPACT OF PROJECT UPON ECONOMY - the estimator's judgement of the expected effect of the project upon the economy

2.3.D
LEVEL OF CRITERION SIGNIFICANCE

NATIONAL	PROVINCIAL	REGIONAL	LOCAL	NEGLIGIBLE	*Why?*

2.3.E
EXPECTED IMPACT OF PROJECT UPON ECONOMY

HIGH	MODERATE	LOW	*Why?*

2.3.F
DESCRIBE FUNCTION

Provide highlights only

7.5.2 (cont.) Step 4 of Stage Two *"Detailed Analysis"*: Summary of Project Benefits, Significance and Expected Impact

- provides a relative rating of the level of occurrence of project values, their significance and the degree to which they are expected to impact the economy.
- Step 4 is a summary of Step 3. While numerical summaries are provided, the evaluator should also note in writing the implications of the summary, important project values that may be affected by cancellation or relocation and mitigative measures that may be appropriate.
- provides a summary for all project values

(Fill in number of occurrences in each space provided)

2.4.C
ARE CRITERIA PRESENT?

Summary of Project Benefit Significance and Expected Impact

	YES	LIKELY	POSSIBLY	NO	UNKNOWN	CRITICAL *
4.1 Employment Benefits						
4.2 Economic Benefits						
4.3 Production Benefits						
4.4 Urban Development Benefits						
Total Occurrences						

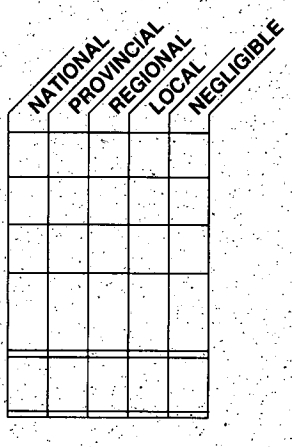
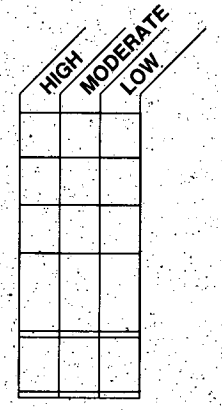
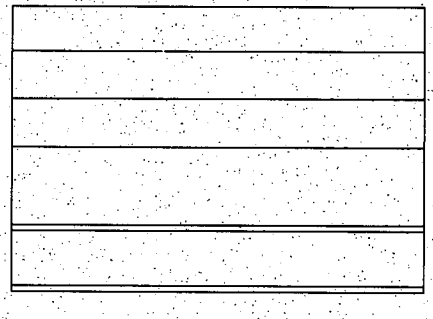
* *(only if listed yes)*

Trigger Factors: *a combination of factors may suggest wetland protection, project acceptance and/or mitigation of project* ***if*** *the two critical criteria are marked "yes", criteria are present* ***and/or***

The evaluator should ensure that any relevant information useful to the decision maker should be summarized in the space provided.

Wherever a trigger factor is noted, the evaluator should determine if a decision should occur at that point.

Note: Generally, fewer nationally significant functions are required to denote a nationally significant project than those required to denote a locally significant project. Also, a combination of several nationally significant functions and a large number of regionally significant functions could denote a provincially significant project. In this summary, reasonable judgement, recognizing the breadth of potential findings, is necessary to provide direction for project acceptance, rejection or deferral to Stage Three.

2.4.D LEVEL OF CRITERION SIGNIFICANCE		2.4.E EXPECTED IMPACT OF PROJECT UPON ECONOMY		2.4.F COMMENTS
				
over 50% of criteria have national/ provincial/regional significance	***and/or***	*over one third of expected project impact on the economy is high*	***then,***	*the evaluator should recognize that the project has major significance.*

7.5.2 (cont.) Step 5 of Stage Two *"Detailed Analysis"* – Overall Summary of Wetland and Project: Key Benefits and Disbenefits

This summary is based on: values, their presence and significance; critical values; and trigger factors. It can be used in preparing the Recommendations (Step 6).

Wetland/Project Key Benefits/Disbenefits

Wetland Key Benefits

Wetland Key Disbenefits

Project Key Benefits

Project Key Disbenefits

Notes

(use this space to summarize key findings)

7.5.2 (cont.) Step 6 of Stage Two *"Detailed Analysis"*: Recommendations

The preceding Multiple Value Evaluation Matrix (Steps 1 to 5) provides the means to examine the interrelationships of the proposed project and affected wetlands. Given the scope of this Detailed Analysis, the evaluator is requested to provide a detailed description of the rationale for the recommendations, necessary conditions and suggested mechanisms and method to ensure appropriate action.

The evaluator should refer to each of the two summary tables (Steps 2 and 4) and identify the extent to which: the wetland is deserving of special consideration and protection, the project is deserving of special consideration and should proceed with or without mitigation, or the entire evaluation should be referred to Stage Three.

- To assist in the recommendation, the evaluator should complete the benefit/disbenefit information of Step 5 on page 90-91.
- If Stage Three is recommended, the evaluator should set out key issues needing attention in the space provided below.
- Recommended action should be justified on the basis of the Stage Two analysis. The evaluator may develop specific summary tables to assist in identifying any mitigation requirements.

Recommended Action

- ❑ Proceed with Project
- ❑ Proceed with Conditions/Mitigation
- ❑ Go to Stage Three Evaluation
- ❑ Do Not Proceed with Project

Comments/Rationale/Conditions or Issues needing attention in Stage Three

(add additional pages if necessary)

Evaluator's Signature

Date

Representing

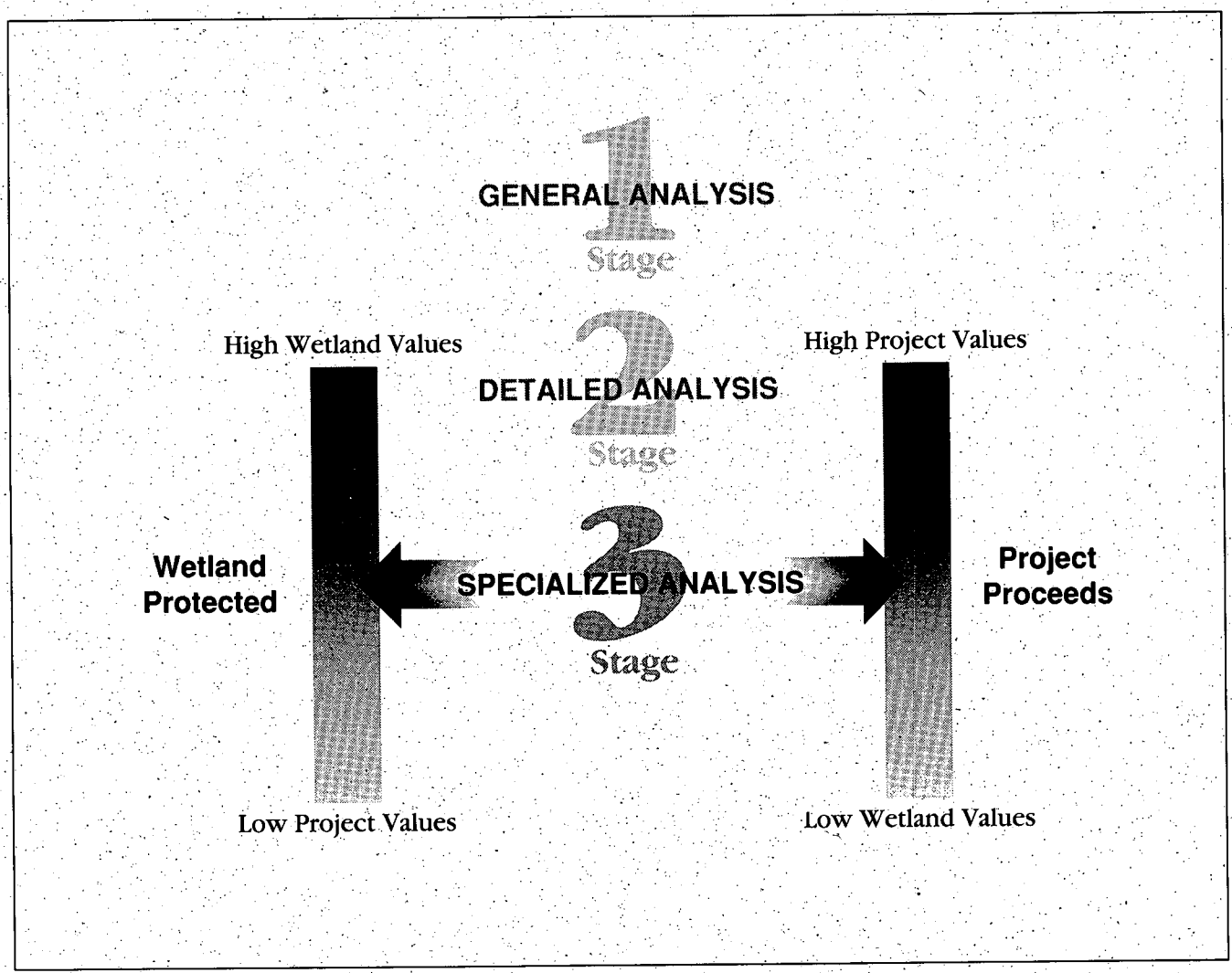


Figure 7.3 Stage Three: Specialized Analysis

7.6 Stage Three *"Specialized Analysis"*

Stage Three requires that the evaluator have or retain specific expertise in resource economics, biology and financial assessment.

Stage Three "Specialized Analysis" places emphasis upon the calculation of precise market and non-market economic production costs and benefits occurring from wetlands and from proposed development with potential impact (Figure 7.3). It is expected that such detailed evaluations will be driven by the need to place non-market and market values upon wetland production functions so that those wetland uses or benefits (typically poorly documented) can be compared with project market production functions (functions which are typically well documented).

The emphasis of Stage Three will be upon detailed impact assessment and estimation of the social and economic benefits and costs to society associated with those impacts. In most cases, it will be necessary to collect additional data and perform analysis in order to estimate and evaluate the impact in terms of benefits and opportunity costs. Such considerations will very likely, of necessity, be performed by resource economists, biologists and pertinent project specialists.

Only a small percentage of projects under evaluation should reach Stage Three.

7.6.1 Instructions to Evaluators

This stage of the Guide should be initiated only if Stage One or Two cannot provide sufficient information, or if significant wetland functions will likely be detrimentally impacted by the proposed development project. This will likely only be completed for major projects, and nationally or provincially significant wetlands.

Stage Three should be undertaken by an individual who is competent and conversant in resource economics. Therefore, the text here is not meant to be inclusive, but rather as a guideline for qualified resource economists. A high level of information and expertise is required at this stage.

Stage Three emphasizes the opportunity cost of the alternatives for wetland conversion. It requires the full and proper accounting of all benefits and all costs of proceeding or not proceeding with a project. The frame of reference must be legitimate, accurate and consistent. Sensitivity analysis must be conducted for key results.

Cautionary notes

- do not measure secondary or transfer benefits
- examine the cost/benefit analysis of projects as carefully and intensively as the analysis of the wetlands
- make use of future demand estimates and scarcity to value future benefits and costs
- carefully identify missing data; outline the methods used to estimate missing data, such as *sensitivity analysis* and shadow pricing (hedonic price method)
- determine and report on the range of *social discount rates* used, describe the approach taken to discounting and the assumptions made
- clearly report whether *marginal values* or *average values* of wetland change have been calculated

Key Concepts

Key economic concepts utilized in the instructions and cautionary notes are briefly described.

Opportunity Cost

The opportunity cost of the current use of some good or of some input is its worth in some alternative uses. The opportunity costs of a wetland are the benefits that society or individuals lose when this wetland is protected. For example, in the case of a wetland to be drained for agriculture, the opportunity cost of conservation is the net benefits of agricultural use (e.g. cereals and vegetable production) foregone with the conservation of the wetland. The opportunity cost of development are the net benefits of conservation (e.g. subsistence and commercial production, recreation, water supply, etc.) foregone with the transformation of this wetland into farmland. Opportunity costs may play an important role in the political decision-making process.

Secondary or Transfer Benefits

Secondary benefits consist of the economic impacts derived from the expenditures made by governments, businesses or people. In benefit-cost analyses (BCA) the existence of unemployment occasionally leads some analysts to augment the benefits from projects by reasoning that the project expenditures may raise employment and income in other sectors of the economy. However, calculating secondary benefits from expenditures associated with a particular project ignores the fact that expenditure from alternative courses of action would also create the same kind of benefits and should also be calculated. In other words, it would be a transfer of benefits from one project and location to another one, but at the macro level (region, province, nation) the expansionary effects on income and employment would be more or less the same. For this reason and because in the BCA one needs to eliminate consequences which are common to alternative courses of action it is recommended that the analyst avoid adding secondary benefits to the BCA of projects, particularly in circumstances where unemployment is widespread. Secondary benefits often involve transfers of income from areas and persons to others. While these effects could be important at the local level (e.g. a particular project or wetland), they are irrelevant in estimating what the implications of a project are for ***total*** production, consumption and employment opportunities in the economy at the regional, provincial or national level.

Sensitivity Analysis

Sensitivity analysis is an analysis in which the values of key variables are changed to see what is the effect on the total outcome. In this simple technique, different possible values for variables with unknown values are used to construct alternative scenarios of outcomes for presentation to the decision maker. These analyses are also used to estimate surrogate values for missing data.

Social Discount Rate

The discount rate is the interest rate used to reduce future benefits and costs to their present-day equivalent. The discount rate is a percentage; the higher the discount rate, the less any future benefit or cost is worth today. In the same way that consumers and producers discount future values, social benefits and costs must also be discounted. Calculation of a social benefit-cost ratio requires that a discount rate be chosen. What value it should take has been the subject of much debate. Two different bases have been suggested: the social opportunity cost rate and the social time preference rate, which is lower. Because of the uncertainty in specifying a particular social discount rate at this time, analysts are encouraged to calculate the present value of benefits and costs for a range of social discount rates. This is a form of sensitivity analysis (see above). It should be noted that because future benefits and costs are calculated in real terms (in constant dollars), discount rates should also be in real terms and not nominal rates net of inflation.

Selection of a discount rate can have a dramatic effect on the outcome of a benefit-cost analysis and, hence, the advice provided to a decision maker. The higher the discount rate, the more the short-term benefits of a project are emphasized. The lower the discount rate the more the longer-term benefits of conserving the values of natural resources are favoured. Hence, the selection of a range of social discount rates must be done carefully, with the approach being described and the assumptions noted.

Average and Marginal Values

There is an important difference between these two concepts. The first one: average value represents the total value of something divided by the number of units, while the marginal value is the additional value of having one additional unit. This difference has important consequences. For example, in the case of public transportation, the cost of an additional passenger (up to the last place) in a bus, or marginal cost, is practically nil since the cost of running a bus does not change much whether it runs empty or full. However, the average cost per passenger (total cost of running the bus divided by the number of passengers) could be very high indeed if the bus carries only two passengers.

In many instances, incremental development of a portion of a wetland through, for example, agricultural drainage represents a marginal loss in any given case, and should be calculated using marginal values, unless a physical threshold is achieved and the viability of the entire wetland is threatened. In reality, however, data available concerning the benefits of the proposed project and regarding the range of wetland benefits foregone if the project proceeds usually lend themselves to the calculation of average values, rather than marginal values.

7.6.2 Framework for Analysis

In order to provide guidance to Stage Three analyses, in Step 1 the working matrices "Significant Wetland Value/Project Impact Relationship" and "Significant Project Value/Project Impact" which follow below should be completed. These working matrices summarize the expected impact of the project on significant wetland values and the economy. As a result, the matrices indicate where special attention should be focused in developing market and non-market wetland and project valuation. The evaluator should return to Section 7.5.2 Step 1 (2.1.E) (p. 52-77) to determine the expected level of project impact upon wetland values and to Section 7.5.2 Step 3 (2.3.E) (p.80-87) to determine the expected level of project impact on the economy.

An example:

If 1.1.1, 1.1.4, 2.2.1, 3.3.1, are nationally, provincially or regionally significant wetland values and are highly impacted, place under HIGH; if 2.2.4, 2.3.2, 3.1.5, are nationally, provincially or regionally significant wetland values and are moderately impacted, place under MODERATE as follows:

7.6.2 (cont.) Step 1 of Stage Three *"Specialized Analysis"* : Working Matrix

Example of Step 1 of Stage Three *"Specialized Analysis"*: Working Matrix

Significant Wetland Value/Project Impact Relationship Matrix		
a. Significant Wetland Values	Expected Project Impact (from Section 7.5.2, Stage Two - Step 1) (2.1.E)	
	HIGH	**MODERATE**
- these are nationally, provincially or regionally significant evaluation criteria. (see section 7.5.2 Step 1 (2.1.D))	1.1.1 recharge regional water supply 1.1.4 erosion control 2.2.1 wildlife viewing 3.3.1 peat source Major required focus of market and non-market production valuation, i.e. "Significant Wetland Values under High Impact"	2.2.4 sport hunting and fishing 2.3.2 education and interpretation 3.1.5 soil moisture increase Secondary focus of market and non-market production valuation, i.e. "Significant Wetland Values under Moderate Impact"

These itemized values should direct the Stage Three valuation phase.

Step 1 of Stage Three *"Specialized Analysis"*: Working Matrix

Significant Wetland Value/Project Impact Relationship Matrix		
a. Significant Wetland Values: nationally, provincially or regionally (2.1.D)	Expected Project Impact (from Section 7.5.2, Stage Two - Step 1) (2.1.E)	
	HIGH	MODERATE

(to complete, see description and example on page 98)

Step 1 of Stage Three *"Specialized Analysis"*: Working Matrix

Significant Project Value/Project Impact Matrix		
b. Significant Project Values: nationally, provincially or regionally (2.3.D)	Expected Impact of Project on Economy (from Section 7.5.2, Stage Two - Step 3) (2.3.E)	
	HIGH	MODERATE

(to complete, see description and example on page 98)

7.6.2 (cont.) Step 2 of Stage Three *"Specialized Analysis"* : Valuation of Significant Wetland and Project Values

Each of these itemized wetland values should be listed and dollar valuation provided using techniques described in Section 7.6.3 starting on p.105. A consistent frame of reference is required (national, provincial or regional). The following blank sheets (p.102, 103 and 104) should be used to provide valuation totals and comparisons. For example:

Example of Step 2 of Stage Three *"Specialized Analysis"*: Valuation of Significant Wetland and Project Values

a. Significant Wetland Values

Significant Wetland Values under High Impact	Estimated Value ($) *(use methods described in Section 7.6.3 and available data and analyses)*
1.1.1 Regional Water Supply 1.1.4 Erosion Control 2.2.1 Wildlife Viewing	$$$ *(use the Working Matrix on page 102)*
Significant Wetland Values under Moderate Impact	Estimated Value ($)
2.2.4 Sport Hunting and Fishing 2.3.2 Education and Interpretation 3.1.5 Soil Moisture Increase	$$$ *(use the Working Matrix on page 103)*
Total	$$$

b. Significant Project Values

Significant Project Values	Estimated Value ($)
4.1.1 Employment Opportunities 4.4.2 Major Transport Link	$$$ *(use the Working Matrix on page 104)*
Total	$$$

These totals should be compared using a cost/benefit ratio to estimate the relative degree of project impact and benefit. Secondary or transfer benefits should be avoided.

Step 2 of Stage Three *"Specialized Analysis"*: Valuation of Significant Wetland and Project Values

a. Significant Wetland Values	Please explain method to obtain estimate, discount rate used, and sensitivity analysis
Significant Wetland Values under High Impact	Estimated value ($)
Total	

(to complete, see description and example on page 101)

Step 2 of Stage Three *"Specialized Analysis"*: Valuation of Significant Wetland and Project Values

a. Significant Wetland Values	Please explain method to obtain estimate, discount rate used, and sensitivity analysis
Significant Wetland Values under Moderate Impact	Estimated value ($)
Total	

(to complete, see description and example on page 101)

Step 2 of Stage Three *"Specialized Analysis"*: Valuation of Significant Wetland and Project Values

b. Significant Project Values	Please explain method to obtain estimate, discount rate used, and sensitivity analysis
Significant Project Values	Estimated value ($)
Total	

(to complete, see description and example on page 101)

7.6.3 Estimating the Economic Values

Note: This section provides general information on uses and techniques for detailed economic valuation. It is not meant to act as a guide for actual application.

New techniques developed in resource economics allow each of these outcomes or attributes to be valued in economic terms. Economists have developed ways to evaluate environmental amenities and other goods that are not necessarily bought and sold in the market. Thus, it is possible to value improvements in water quality, reductions in wildlife populations, and even changes in ecosystem diversity that may occur as a result of wetland intervention and manipulations. Valuing these non-market goods in terms of dollars is complex and the methods of analysis are technical. This valuation process almost always requires the collection of new data and the involvement of professional economists and other experts. While these valuation techniques are becoming more widely used, they are new and are the subject of continuing research. Thus, they are evolving rapidly. Consequently, this kind of evaluation can and should be done only on significant projects of unique and critical importance, nationally, provincially, regionally or locally, when the decision cannot be reached by other mechanisms. Hence it should only be attempted at the Stage Three level.

Guidelines for a Social Cost/ Benefit Analysis

A social cost/benefit analysis requires special attention to the accounting stance used to conduct the analysis. Social cost/benefit analysis focuses on the estimation of the net social benefits associated with the project, as opposed to the regional impacts or the financial impacts.

In addition, a social cost/benefit analysis should measure in economic terms, all impacts of the proposed project. For any project under evaluation, some of the impacts of the project will be directly reflected in the supply or demand of marketed goods. Measurement of these direct market impacts are fairly straightforward. In the case of wetlands, however, it is very likely that the economic impacts of the proposed project will not be limited to economic impacts that are directly reflected in the markets. The evaluator should ensure that public subsidy is accounted for in this assessment. In fact, it is likely that while many of the "benefits" of the project will be directly reflected in the demand for market goods, many of the "costs" of the proposed project will be associated with impacts on goods and/or services for which there is not direct market. Often those proposing the project will be able to provide important information with

Photo: C. Rubec

Urban expansion results in the loss of many small wetlands.

respect to the direct market impacts of the project such as jobs and expenditures. However, it is unlikely that the proponent of the project will have assembled information regarding the economic impact of the project on non-market goods such as recreation benefits or loss in environmental quality. Consequently, while the evaluator will be able to obtain important economic information from the project proponent, it will be important for the evaluator to ensure that proper data are collected that will allow the cost/benefit analysis to include economic impacts to non-market goods. The next section provides an overview of economic issues and terminology related to non-market goods.

Non-market goods or services may generate economic value for many reasons.

Use Values

Suppose for example that development of a wetland reduced the number of waterfowl available for hunting. These waterfowl are one component of the value of waterfowl hunting trips. The reduction in waterfowl then has an economic impact that is reflected in a reduction in the number and/or quality of waterfowl hunting trips. Consequently, the development of the wetland may have an economic impact by changing the value and/or number of waterfowl hunting trips. Any reduction in the value of consumptive uses of the wetland or the services produced by the wetland should be included as a cost in the social cost benefit analysis of the proposed project.

Hunting and fishing represent non-market goods dependent on the consumptive use of a resource. That is to say, a fish caught by one angler is unavailable to be caught by another. There are non-market goods involving wetlands (or its functions) that are non-consumptive. For example, people might visit a wetland to view waterfowl. The value of a non-consumptive trip may be affected by the level of services provided by the wetland. Other services provided by the wetland can be the basis for non-consumptive use benefits. For example, wetlands may provide boating opportunities, or visual services that may be affected by the proposed project. Any reduction in the value of non-consumptive uses caused by the project should be included as costs when calculating net social benefits of the project.

Photo: C. Rubec

Salt marsh habitat at Alaksen National Wildlife Area, Delta, British Columbia.

Non-use Values

In addition to the consumptive and non-consumptive uses of a wetland that may generate economic benefits, it is possible that economic values can arise without a direct connection between the individual enjoying the benefits and the wetland. These "non-use values" can fall into two general categories: option value or existence value.

Option Value and Option Price

An individual may not be a current user of services provided by the wetland and is uncertain whether he/she will be a user at some point in the future. This uncertainty about the future use could arise either because the individual is uncertain whether he/she will want to use the resource in the future or because he/she is uncertain whether the wetland services will be available for future use. Option price is the amount the individual would be willing to pay today to preserve the option of use at some future date. The algebraic difference between option price and the expected value of benefits (consumer surplus) is option value. A great deal of effort has been devoted to addressing the question of whether option value is positive or negative and whether option price or option value is the appropriate economic measure of the value of a resource under conditions of uncertainty. It is difficult to say much about the sign of opinion value under general conditions. While some differences of opinion are still present, there appears to be a growing consensus that option price (or some closely related measure) is the relevant measure of value under uncertainty. If the proposed project for the wetland has uncertain effects on future consumptive and/or non-consumptive use values, a complete cost/benefit analysis should address the question of whether the project significantly affects option prices for the uncertain future uses.

Existence Values

Individuals might suffer economic losses from the development of a wetland even if the individual is not a current user and will not be a future user. These damages could arise because of feelings of altruism for others, altruism toward the environment, a desire to preserve the wetland for future use by others, or empathy towards the environment in general or the organisms that are present in the environment. For any or all of these reasons, a person may suffer an economic loss because of what they perceive to be a negative change to the environment. These values are often referred to as existence values.

As with the concepts of option price and option value, there are differences of opinion among resource economists regarding the relevance of existence values in conducting a social cost/benefit analysis. While the theoretical basis of existence values is widely accepted, techniques for measuring these values are less well accepted and there is also controversy about the likely magnitude of existence values. The strongest case of maintaining that existence values are large is made when the proposed project has long-term or irreversible impacts to relatively unique resources. However, the question of the magnitude of damages to existence values caused by short-term damages to non-unique resources (for example, a temporary decrease in a muskrat population) is largely an empirical question.

In summary, the goal of the economic analysis should be to measure all of the economic impacts attributed to the course of action being posed for the wetland, regardless of whether the impact is reflected in a change in the value of marketed goods or a change in the value of non-marketed goods.

Ways of Estimating Non-market Values

Replacement Cost Method

One way to estimate the value of something is to consider the cost of replacing it. Applied to wetlands, it would involve the costs associated with constructing a new wetland with the same characteristics in another location. While this seems simple, it has several drawbacks. First, it may not be clear whether or not society needs a particular wetland or its attributes - whether or not it needs to be replaced. Second, there is debate whether a new wetland in another area can possibly substitute for one lost. A third concern is that it is nearly impossible to replicate (or even understand the dynamics) of all the attributes of the wetland so that they could be replaced. Replacement cost methods work best where it is clear that a substitute is needed and will be created, and where only a single or small number of attributes are involved.

Consider the case where a small and not very rich wetland may be very expensive to replace (all nearby alternatives would involve purchase of expensive land, extensive excavation, blasting etc.) In this case replacement cost could be much greater than the intrinsic value of the wetland - clearly overestimating the non-market value. In contrast, a small, biodiverse and historically important wetland might be easily "replaced" hectare for hectare by something which appeared similar (perhaps by a minor extension to a nearby existing wetland). In this case the estimate for replacement cost would clearly underestimate the range of values associated with the wetland. Some values (e.g. cultural and historical benefits) may not be replicable. While this approach can help to identify some of the issues in valuation, it is a limited tool in dealing with the non-market values of complex environments like wetlands.

Travel Cost Method

The travel cost method is based on the idea that the value of something can be estimated by the amount of expense individuals are prepared to incur to get there to use it. If the site is changed, will people be willing to pay more, or less, to get there? (If the beach is removed, will fewer people want to drive the distance to use the wetland?) Information on people's travel behaviour is often difficult to measure, particularly since many people may visit more than one destination on a trip (stopping to see Aunt Bertha, pick berries or visit a cheese factory en route). Also, some people seem to enjoy travel for its own sake (Let's go for a drive!). A related approach is to ask, if the wetland is no longer available, how far will people drive to get to the next best site?

A complication is that many will not in fact go to another wetland, instead substituting another form of activity such as cycling or the movies. For those attributes of a wetland that people must travel to see or use (photography, nature study, hunting) this approach has some utility. For other functions where there is no need to visit the site to benefit, (migratory waterfowl production, toxic buffering, water purification) this approach will not serve to estimate the non-market values.

Hedonic Price Method

This method infers the value of something by comparing a situation with it present to one without. If a house with a view of a wetland sells for $10 000 more than a similar one nearby without the view, it is assumed that the additional price reflects the value of the view. This assumes a perfect market where a large number of knowledgeable buyers and knowledgeable sellers establish the price difference for houses with this feature. Such markets are difficult to find and to isolate for any particular value. Often there are other factors which account for part of the observed difference. It is also difficult to ascertain exactly which attributes of something as complex as a wetland account for the difference (beauty, landscape diversity, ability to see birds, smell of the wetland). Like travel cost, because it depends on observation of actual human behaviour, this approach cannot be used to estimate non-use values such as toxic buffering or existence value.

Contingent Valuation Method

The contingent valuation method infers value by asking people, given a hypothetical market, how they would behave. For example, how much would they be prepared to pay to save a marsh, or how much would they demand as compensation for the loss of access rights to a wetland for hunting or for nature photography? By focusing on how people say they would behave, the contingent valuation method avoids many of the theoretical and statistical difficulties encountered in the travel cost method and the hedonic price method.

This method is becoming increasingly used to estimate values for non-market attributes (e.g. the cost of aesthetic or recreational capabilities damaged due to an oil spill, the value of public parks to a region). Limits to the utility of contingent valuation generally relate to the validity of the link between stated willingness-to-pay (or accept compensation) for something and real behaviour. Individuals may say they are prepared to pay $100 to save the louse-wort, yet if actually asked to pay may be prepared to contribute much less. Similarly, it is often very difficult to link willingness-to-pay to a particular wetland (as opposed to all wetlands) or to a particular benefit coming from a wetland (a view) as opposed to all wetland functions. Any surveys must carefully ensure that the respondent understands both the good they are being asked to evaluate (e.g. access for viewing or hunting rights) and the context of the transaction they are being asked to consider (e.g. what are the conditions and alternatives - donations, user fees, increased taxation, etc.), and to whom would it be paid?

While the contingent valuation method is simple in concept, it is more difficult in practice. A key concern with respect to use of contingent valuation is the way in which questions to respondents are framed. If a question is badly phrased, it may distort the reply; are we asking about willingness-to-pay to gain something, or willingness to be compensated for loss of something? While in theory these should be the same, in practice the responses can sometimes differ significantly as evidence suggests that people may value the loss of something they already have differently than something they do not yet possess.

7.6.4. Evaluation Sources

(For further information on non-market valuation the following sources should be consulted)

Anderson, G.D. and R.C. Bishop. 1986. The Valuation Problem. In *Natural Resource Economics, Policy Problems and Contemporary Analysis*, Chapter 3, pp. 89-191. Kluwer and Nijhoff Ltd. Boston, Mass.

Bockstael, N.E. and K.E. McConnell. 1981. Theory and estimation of the household production function wildlife recreation. *Journal of Environmental Economics and Management* 8: 199-214.

Brookshire, D.S., M.A. Thayer, W.P. Schulze, and R.C. d'Arge. 1982. Valuing public goods: a comparison of survey and hedonic approaches. *American Economic Review* 72(1): 155-176.

Clawson, M. 1959. *Methods of Measuring the Demand for and Value of Outdoor Recreation*. Reprint No. 10, Resources for the Future. Washington, D.C.

Cummings, R., D.S. Brookshire, and W.D. Schulze (eds.). 1986. *Valuing Environmental Goods: State of the Art Assessment of the Contingent Valuation Method*, Rowman and Allanheld Publishers. Totowa, N.J.

deGroot, R.S. 1988. Environmental Function: An Analytical Framework for Integrating Environmental and Economic Assessment. In *Proceedings, Workshop on Integrating Environmental and Economic Assessment: Analytical and Negotiating Approaches*. Canadian Environmental Assessment Research Council, Vancouver, B.C.

Desvousges, W.H., V.K. Smith, and M.P. McGivney. 1983. *A Comparison of Alternative Approaches for Estimating Recreation and Related Benefits of Water Quality Improvement*. Report to the U.S. Environmental Protection Agency, EPA-230-05-83-001, Washington, D.C.

Filion, F.L. 1988. Managing for Sustainable Development: The Strategic Role of Economic and Social Aspects of Wildlife. In *Proceedings, Second International Wildlife Symposium*. The Wildlife Society of Mexico, Mexico City.

Freeman, A.M. III. 1979. *The Benefits of Environmental Improvement: Theory and Practice*, John Hopkins University Press, Baltimore, Md.

Kahneman, D. and J.L. Knetsch. Valuing public goods: the purchase of moral satisfaction. *Journal of Environmental Education*, (at press).

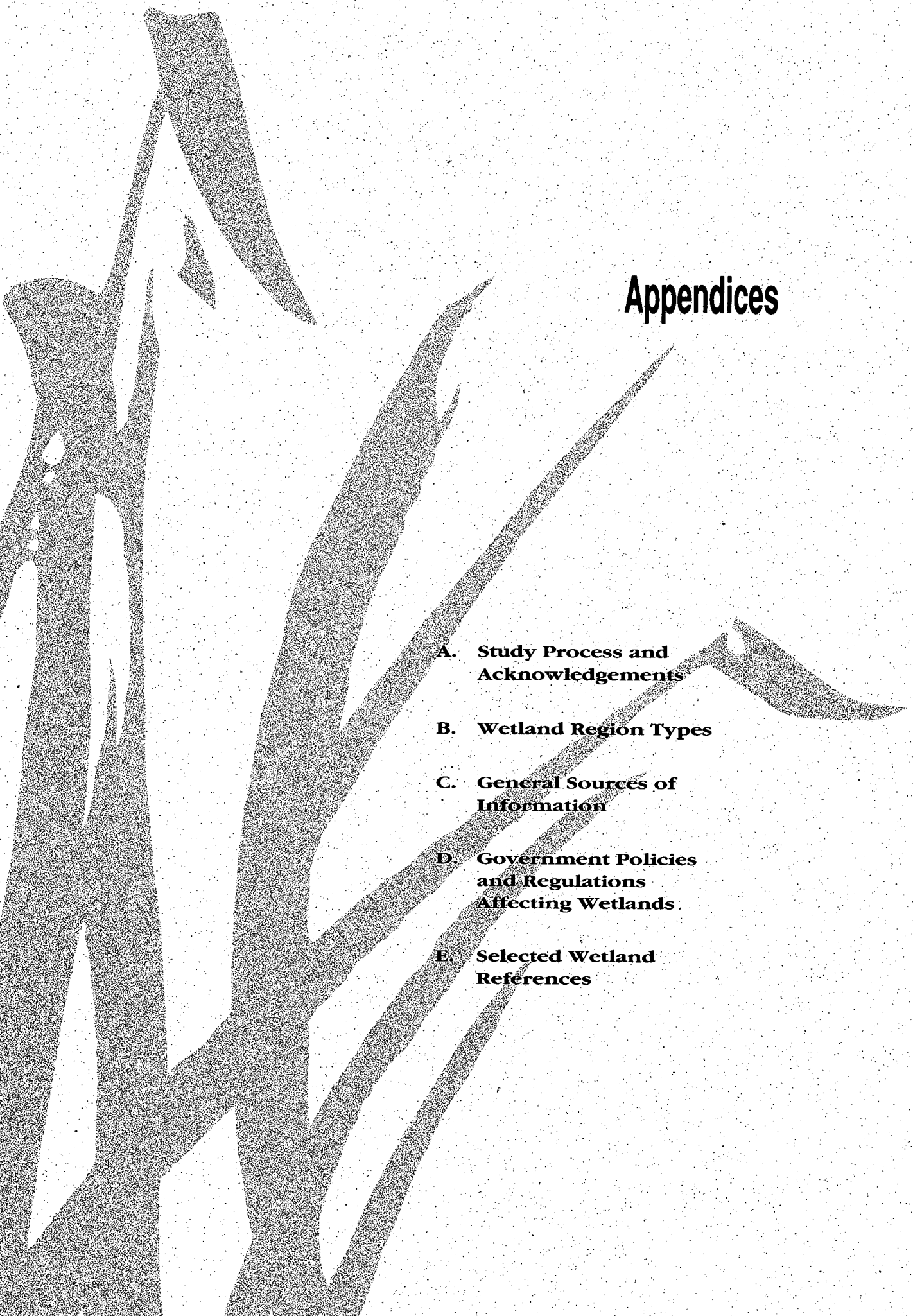
Krutilla, J.A. 1967. Conservation reconsidered. *American Economic Review* 57: 777-786.

Mitchell, R.C. and R.T. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Resources for the Future. Washington, D.C.

Randall, A. and J.R. Stoll. 1983. Existence Value in a Total Valuation Framework. In *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*, R.D. Rowe and L.C. Chestnut, eds., Westview Press, Boulder, Col.

Rosen, S. 1974. Hedonic prices and implicit markets: product differentiation in pure competition. *Journal of Political Economy* 82: 32-55.

U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. Report No. Y3.W29: 8. pp. 1-137. Washington, D.C.



Appendices

A. Study Process and Acknowledgements

B. Wetland Region Types

C. General Sources of Information

D. Government Policies and Regulations Affecting Wetlands

E. Selected Wetland References

Appendix A

Study Process and Acknowledgements

The following outlines the process undertaken during the "Wetlands are Not Wastelands" project.

Study Process

The project has been undertaken in a number of distinct phases, namely:

1. a preliminary workshop on alternative evaluation methods,
2. a literature review of alternative evaluation methods,
3. four pilot studies to test proposed evaluation methods in different regions of Canada,
4. a workshop of specialists to review the pilot study results and propose an outline for the *Wetland Evaluation Guide*, and
5. the drafting, review, revision and testing of the *Wetland Evaluation Guide* itself.

Each of the earlier phases is briefly described below. Workshop participants, authors of studies and steering committee members are also gratefully acknowledged.

Phase 1

Preliminary Workshop
Evaluating Renewable Resources (Wetlands) – *October 20 - 21, 1986*

A list of methods of evaluating renewable resources was developed. The methods included:

- a multiple functions approach synthesizing a range of societal goals and objectives for the use of wetland functions broader than those generally encompassed by the term "economic", which potentially could be employed as a screening technique;
- a social cost/benefit approach involving opportunity cost concepts to be applied to measurable wetland values and to the proposed alternate use; and
- techniques to measure the willingness-to-pay for wetland benefits based on contingent valuation methods which can provide estimates to the social cost/benefit approach.

Participants

Edward W. Manning,
Sustainable Development Branch,
Environment Canada, Ottawa,
Co-Chairperson

Kenneth W. Cox,
Canadian Wetlands Conservation
Task Force, Ottawa, Co-Chairperson

Hamid Jorjani,
University of Guelph, Guelph

Nicole Lavigne,
Sustainable Development Branch,
Environment Canada, Ottawa

Lynda Maltby,
Canadian Wildlife Service, Ottawa

Carl Mitchell,
North-South Intermedium, Ottawa

John Morgan,
Manitoba Habitat Enhancement
Land Use Program, Winnipeg

Ted Schrecker,
Trent University, Peterborough

Phase 2

Literature Review of Alternative Evaluation Methods

A report was prepared to provide the conceptual bases and operating procedures for implementing the methodological approaches selected for wetland evaluation. Recommended sites for conducting pilot studies were also provided.

PRODUCT:

Title
Wetland Evaluation: Methodology Development and Pilot Area Selection, August 1987.

Author
Michal J. Bardecki,
Ryerson Polytechnical Institute, Toronto

Steering Committee
Edward W. Manning,
Kenneth W. Cox,
Nicole Lavigne and
Wayne K. Bond, Ottawa

Phase 3

Pilot Studies

Three methodological approaches were applied in four pilot study areas in Canada. These are briefly described below:

- Greenock Swamp is a large treed wetland in the agricultural region of southern Ontario. It is being gradually drained and filled around its edges for agricultural use.
- Cowichan Estuary on Vancouver Island is a rich estuary with salmon habitat, migratory bird staging and considerable recreational use. It has some current logging industry use and is the site of several major industrial proposals.
- Minudie is part of a large coastal wetland system in Nova Scotia (the Tantramar Marshes), drained in the 18th century and now the focus of potential wetland restoration works from its current use as pastureland and hay production. The feasibility of wetland restoration was evaluated.
- The Prairie Potholes of Saskatchewan (two sites were examined, one in the dryland area, the other in the wetter parkland region) are a large region where agricultural drainage and filling has steadily encroached, with significant reduction in pothole areas and waterfowl production.

The four pilot studies were carried out by teams in each of these areas, based upon the three methods identified. The four case studies attempted to examine, and to an extent emulate, the conditions of information availability that would exist for a local planner. All four studies were successfully completed, with mixed results. In some cases, information needed was simply unavailable or required detailed field level collection. In other cases, quite complete application of some of the methods was achieved. As a result, the pilot studies represent a reasonable representation of the methods' application in a variety of circumstances. A number of questions arose which were carried to the next phase; the 1990 Workshop of Specialists. Those involved as authors and steering committee members in each pilot study are acknowledged below.

PRODUCTS:

Pilot Study No. 1
Greenock Swamp, Ontario

Title
Application of Willingness-to-Pay, Opportunity Cost and Cumulative Impact Methods to Greenock Swamp, Ontario, June 1988.

Author
Michal J. Bardecki,
Ryerson Polytechnical Institute, Toronto.

Steering Committee (Ottawa)
Edward W. Manning,
Wayne K. Bond,
Kenneth W. Cox

Pilot Study No. 2
Cowichan Estuary, British Columbia

Title
Application of Wetland Evaluation Methods to the Cowichan Estuary, British Columbia, March 1989.

Authors
Alan Ferguson,
Regional Consulting Ltd., Vancouver

Gary Holman, Marvin Shaffer and Associates Ltd., Vancouver

Ron Kistritz,
R.U. Kistritz Consultants Ltd., Vancouver

Steering Committee
Ken Redpath, Canadian Wildlife Service, Pacific and Yukon Region, Chairperson

Wayne K. Bond,
Sustainable Development Branch, Ottawa

Ian Marshall,
Sustainable Development Branch, Ottawa

Michal Bardecki,
Ryerson Polytechnical Institute, Toronto

Lindsay Jones,
Pacific Estuary Conservation Program, West Vancouver

Bruce Morgan,
British Columbia Ministry of the Environment, British Columbia

Steve Wetmore,
Canadian Wildlife Service, Pacific and Yukon Region

With comments from members of the National Steering Committee.

Pilot Study No. 3
Atlantic Marshlands

Title
Application of Wetland Evaluation Methodologies to the Minudie Dykelands, Nova Scotia, June 1989.

Authors
Peter Stokoe, Jane Roots and Brad Walters,
Dalhousie University, Halifax

Steering Committee
Joe Arbour,
Inland Waters Directorate, Atlantic Region, Chairperson

Wayne K. Bond,
Sustainable Development Branch, Ottawa

Ian Marshall,
Sustainable Development Branch, Ottawa

Michal Bardecki,
Ryerson Polytechnical Institute, Toronto

Zal Davar,
Inland Waters Directorate, Atlantic Region

Hank Kolstee,
Nova Scotia Agriculture, Nova Scotia

Keith McAloney,
Ducks Unlimited Canada, Atlantic Region

Al Smith,
Canadian Wildlife Service, Atlantic Region

Dave Wilson,
Inland Waters Directorate, Atlantic Region

With comments from members of the National Steering Committee.

Pilot Study No. 4
Prairie Pothole Wetlands

Title
Prairie Pothole Wetlands: Functions and Evaluation, Saskatchewan, November 1990.

Authors
Don A. Young,
Environmental Management Associates, Regina and Calgary

John P. Thompson,
Thompson Economic Consulting Services, Calgary

Steering Committee
David M. Gierman,
Canadian Wildlife Service, Western and Northern Region, Chairperson

Wayne K. Bond,
Sustainable Development Branch, Ottawa

Vic Adamowicz,
University of Alberta, Edmonton

Kent Brace,
Canadian Wildlife Service, Western and Northern Region

Doug Craig,
Canadian Wildlife Service, Western and Northern Region

Gordon Lewis,
Inland Waters Directorate, Western and Northern Region

Ross Melinchuk,
International Association of Fish and Wildlife Agencies, Washington, D.C.

With comments from members of the National Steering Committee.

Phase 4

Wetlands Are Not Wastelands: Workshop of Specialists to review study results and develop a framework for the "Wetland Evaluation Guide", Ottawa, January 1990.

The Workshop of Resource Evaluation Specialists engaged in a wide-ranging discussion of the approach, methodologies and applications. The pilot studies were reviewed; the methods were critically evaluated and analyzed from the point of view of their scientific and pragmatic soundness; and guidance was provided concerning the development of means to support better decisions in the form of a Wetland Evaluation Guide.

Participants

Jack L. Knetsch,
Simon Fraser University,
Vancouver, Chairperson

Vic Adamowicz,
University of Alberta, Edmonton

Michal Bardecki,
Ryerson Polytechnical Institute, Toronto

Wayne K. Bond,
Sustainable Development Branch, Ottawa

Kenneth W. Cox,
Canadian Wetlands Conservation Task Force, Ottawa

Phillipe Crabbé,
University of Ottawa, Ottawa

S.A. (Sandy) D'Aquino,
Inland Waters Directorate, Pacific and Yukon Region, Vancouver

Rudolf deGroot,
Wageningan Agricultural University,
Wageningan, The Netherlands

Alan Ferguson,
Regional Consulting Ltd., Vancouver

Fern Filion,
Canadian Wildlife Service, Ottawa

Thomas Heberlein,
University of Wisconsin,
Madison, Wisconsin

Patrice J. LeBlanc,
Federal Environmental Assessment Review Office, Ottawa

Gerry O. Lee,
Canadian Wildlife Service, Ottawa

Edward W. Manning,
Sustainable Development Branch, Ottawa

Jim Marshall,
Forestry Canada, Ottawa

Nigel Richardson,
N.H. Richardson Consulting, Toronto

Ilze Reiss,
Sustainable Development Branch, Ottawa

Barry Sadler,
Victoria, Consultant to the Canadian Environmental Assessment Research Council, Ottawa

Peter Stokoe,
Dalhousie University, Halifax

John P. Thompson,
Thompson Economic Consulting Services, Calgary

Don A. Young,
Environmental Management Consultants, Regina and Calgary

David R. Witty,
Hilderman, Witty, Crosby and Hanna Associates, Winnipeg

Report to the Workshop of Specialists

A report that summarized and integrated the methodological findings and conclusions from the four pilot studies was undertaken to serve as a basis for discussion at the Workshop of Specialists.

Title
Wetlands Are Not Wastelands: Synthesis of Pilot Study Results,
December 1989

Author
Michal J. Bardecki,
Ryerson Polytechnical Institute, Toronto

Scientific Authority
Wayne K. Bond,
Sustainable Development Branch, Ottawa

With reviews by members of the National Steering Committee.

Conclusion

As in any multi-year project with many phases, there have been many other people who contributed in a variety of ways. Appreciation is extended to all those who participated in the pilot studies as field researchers, interviewers, computer analysts, cartographers, wordprocessors or providers of information. To others who assisted the project in any way, a special vote of thanks.

The National Steering Committee,
Wetlands Are Not
Wastelands Project

Appendix B

Wetland Region Types

This appendix examines briefly the twenty wetland regions in Canada. It also considers their distribution and that of wetland classes within the context of broader geographic areas.

Arctic Wetlands

In the Canadian Arctic, there are three wetland regions: High Arctic (AH), Mid Arctic (AM) and Low Arctic (AL). The primary factors affecting development of Arctic Wetlands are very low precipitation and cold temperatures. Permafrost underlies the wetlands at shallow depths and prohibits internal drainage, tending to concentrate the available moisture at the surface. As a result, wetlands are restricted to poorly drained depressions or to areas where additional water nourishes the wetland.

Subarctic Wetlands

Three subarctic wetland regions: High Subarctic (SH), Low Subarctic (SL) and Atlantic Subarctic (SA) occur in Canada. These wetlands are characterized by intensely cold winters but relatively warm summers. Precipitation levels, although higher than in the Arctic, are still relatively low. Because permafrost varies across these regions, it affects wetland formation in different ways, creating a variety of peatland forms.

Boreal Wetlands

Boreal wetlands are characterized by cold winters and warm summers. The continental precipitation gradient and thermal differentiation from north to south is responsible for creating four wetland regions: High Boreal (BH), Mid Boreal (BM), Low Boreal (BL) and Atlantic Boreal (BA). In the sub-humid western part of these regions, wetlands occur generally in depressional areas or where an additional source of water nourishes the wetlands. The dominant wetlands are fens and bogs. In the more humid eastern part of these regions, raised bogs become much more frequent. In the Low Boreal Wetland Region – the most temperate

boreal wetland region - raised bogs and various forms of fens are common. In contrast, the High Boreal Wetland Region displays permafrost features such as palsas and peat plateau bogs.

Prairie Wetlands

Prairie wetlands feature low precipitation, cold winters and warm summers. The low levels of precipitation and the long periods of drought do not promote the development of peat-forming vegetation; hence there are few peatlands. The marshes and shallow open waters that occur in many depressions may be subject to severe drawdowns. Concentration of salts frequently occur in depressions, creating saline water conditions.

There are two Prairie wetland regions: Continental Prairie (PC) and Intermountain Prairie (PI). The Continental Prairie Wetland Region, in southern Alberta, Saskatchewan, and Manitoba is characterized by level to undulating and rolling terrain, broken by valleys, escarpments, and hills. Generally lying at a high elevation, the Intermountain Prairie region, in central British Columbia, occupies a series of eroded plateaus, hills, valleys and terraces.

Temperate Wetlands

Mild winters and warm summers characterize the temperate wetland regions which experience moderately high amounts of precipitation. As a result, temperate wetlands display luxuriant plant growth and marshes, bogs and swamps are common. There are two temperate wetland regions: Eastern Temperate (TE) in southeastern Canada, and Pacific Temperate (TP) in British Columbia.

Oceanic Wetlands

Two small oceanic wetland regions, Atlantic Oceanic (OA) and Pacific Oceanic (OP) occur at Canada's extremes in Newfoundland and British Columbia. These wetlands are characterized by very high levels of precipitation and mild temperatures. Small pools of water and unique peatland forms at higher elevations are often present.

GEOGRAPHIC AREA	WETLAND REGIONS*	PRINCIPAL WETLAND CLASSES
1. Pacific coast	OP; TP	Marsh
2. Prairies	PC; PI; BM (minor)	Marsh, shallow open water
3. Eastern Temperate	TE; BA (minor); BL (minor)	Marsh, bog, swamp
4. Boreal	BA; BH; BL; BM	Bog, fen
5. Atlantic coast and Maritimes	BA; SA; OA	Marsh, bog
6. Northern Canada	AH; AL; AM; SH; SL; ME	Bog, fen
7. Western Cordillera Mountains	MC; MI; MR	Bog, fen

Table A-1 Categorization of wetlands

* *Wetland regions as defined by the National Wetlands Working Group (1986)*

Mountain Wetlands

There are four mountain wetlands regions: Coastal Mountain (MC); Interior Mountain (MI) and Rocky Mountain (MR) located in western Canada; and Eastern Mountain (ME) along the coast of Labrador in eastern Canada. The distribution of wetlands is restricted by the steep topography, with limited wetland development found in valleys or on flat saddles or ridges.

Summary

These seven broad geographic areas across Canada, based upon considerations of climate, vegetation and physiography, provide a context for general wetland region and wetland class demarcation (Table A-1).

Appendix C

General Sources of Information

Wetlands are complex ecosystems; many of their functions and processes are just beginning to be understood. For this reason in many areas of the country detailed information concerning wetlands is often difficult to find. To be able to complete the evaluation portion of this Guide, information on wetland functions and values is required. To help find information about wetlands, there are a number of sources of information in your area which can be accessed. Some of these are listed below:

Agriculture Canada

Canadian Nature Federation

Canadian Wildlife Federation

Ducks Unlimited Canada

Environment Canada
particularly the Canadian Wildlife Service, the Canadian Parks Service, and the Inland Waters Directorate

Federal, Provincial or Municipal Museums

Fisheries and Oceans Canada

Forestry Canada

Municipal Planning Department

Nature Conservancy of Canada

North American Wetlands Conservation Council (Canada)

Provincial Department of Agriculture

Provincial Department of Economic Development

Provincial Department of the Environment

Provincial Department of Fish and Wildlife

Provincial Department of Forestry

Provincial Department of Land or Land Registry

Provincial Department of Natural Resources

Provincial Department of Revenue

Provincial Department of Tourism

Provincial or Local Land Trust

Provincial Naturalist Association

Provincial Wildlife Federation

Statistics Canada

Universities and Technical Colleges
particularly the Departments of Environmental Studies, Biology, Geography, Economics or Business, Archaeology, History, Engineering, Law and Library

Wildlife Habitat Canada

World Wildlife Fund Canada

Appendix D

Government Policies and Regulations Affecting Wetlands

Each level of government has particular methods and tools for the control, management and development of private and public lands. Each case is special; each wetland requires special consideration. Even so, the evaluator should be aware of the types of tools available to control wetland conversion. The following describes some of those tools. For a more thorough review see *Land Use Planning and Sustainable Development in Canada* (Richardson, 1989) available from the Canadian Environment Advisory Council.

Municipal Plans (Urban and Rural)

Municipalities under provincial jurisdiction - enabling legislation varies between provinces - have completed "official plans", "community development plans" or "land use guidelines" which direct development and designate acceptable land use activity. Regional or provincial policies may or may not direct such plans.

A municipality may regulate the use of private land by a zoning by-law and authority to control the subdivision of land. As a result, local authorities display a significant control over the activities which might detrimentally affect wetlands.

Intermunicipal or Regional Plans

Three provinces (Alberta, Ontario and Quebec) have regional land use planning structures. These regional authorities have at their core municipal-driven interests. As a result, while rural land use may fall within their framework considerable attention is actually focused upon urban issues and development. Therefore, intermunicipal plans provide little potential to address regional wetland issues under current situations.

Land Use Policies and Regulations

Within the two previously identified jurisdictions, a variety of land use policies and regulations have been developed. In general where development pressures are the most acute, a variety of development policies, regulations and controls have been developed.

Land use policies are generally prepared and adapted to govern a wide-range of land use situations to cover generic needs. In areas where special considerations are needed, there may be performance standards in place which set out specific objectives that must be met by any approved development. Or, alternatively, there may be site design controls to ameliorate specific potential detrimental impacts. Regulations are specific requirements that must be addressed for a variety of reasons.

Any one of these may be useful in protecting wetland resources, if the applicable land use control addresses specific wetland needs.

Where to Look?

If unfamiliar with the applicable land use controls which may assist in identifying special development control require-

ments, the evaluator should talk to the local municipal office and ask to speak to the planner in charge. That planner can provide specific information about the appropriate land use controls affecting the wetland in question.

Available Tools

Where wetland protection is desirable or wetland values are worthy of consideration in the planning and development process, then the local municipal authority should be encouraged to examine alternative methods such as wetland zoning categories based upon type of function and value; modified development review procedures based upon special consideration of environmentally sensitive areas; and municipal environmental impact assessment procedures for development that is identified to have particular potential environmental effects.

Provincial and Federal Policies

At the present (March 1992), the Federal Government has published *The Federal Policy on Wetland Conservation.* Three provinces have public consultations underway for provincial wetland policies: Alberta, Saskatchewan and Ontario.

Appendix E

Selected Wetland References

Canada's Wetlands. 1986. (a) Distribution of Wetlands, (b) Wetland Regions. Energy, Mines and Resources Canada and Environment Canada. Ottawa. National Atlas of Canada Map Folio, 2 maps at 1:7 500 000 and wetland fact sheet. Authored by the National Wetlands Working Group.

The North American Waterfowl Management Plan. 1986. Environment Canada and the United States Department of the Interior. Ottawa and Washington. 19 p. An overview of the 15-year internationally funded plan to secure and enhance over 2 million hectares of Canadian wetland and upland habitats to reestablish waterfowl populations.

Wetlands in Canada: A Valuable Resource. 1986. Lands Directorate, Environment Canada. Fact Sheet No. 86-4. Ottawa. 8 p. A detailed review of the status and issues involved in wetland loss across Canada.

The Canadian Wetland Classification System. 1987. Ecological Land Classification Series, No. 21. Canadian Wildlife Service, Environment Canada. Ottawa. 14 p. Booklet with standardized definitions, terminology and classification keys for all wetlands across the nation. Authored by the National Wetlands Working Group.

Wetlands of Canada. 1988. Ecological Land Classification Series, No. 24. Canadian Wildlife Service, Environment Canada and Polyscience Publications Inc. 452 p. Ottawa and Montreal. A definitive text on the characteristics, ecology and issues facing wetland management in Canada. Authored by the National Wetlands Working Group.

Preserving Great Lakes Wetlands: An Environmental Agenda. 1990. Final Report by The Great Lakes Wetlands Policy Consortium. Conway, Michigan. 78 p.

Wetlands of North America. 1991. Thomasson-Grant, Charlotteville, Virginia. U.S.A. A pictorial look at the richness and beauty of wetlands across Canada and the U.S.A. with brief text and maps. Authored by B. Littlehales and W.A. Niering.

Wetlands. 1991. International Waterfowl and Wetlands Research Bureau, Slimbridge, Gloucester, United Kingdom. 224 p. A broad overview of wetlands in all areas of the world with a balanced presentation of photographs, text, data analyses, and graphics. Authored by M. Finlayson and M. Moser.

Wetlands in Canada: Canada's Ramsar Sites. 1991. Canadian Wildlife Service, Environment Canada. Ottawa. 40 p. An overview of the characteristics, management and distribution in Canada of 30 major wetland systems designated as internationally significant under the Ramsar Convention. Authored by D.I. Gillespie, H. Boyd and P. Logan.

The Federal Policy on Wetland Conservation. 1991. Government of Canada. Ottawa. 14 p. An examination of goals and strategies for conserving Canada's wetlands and the federal role in this national initiative.

Background Documentation to the Wetlands are Not Wastelands Project

Bardecki, M.J. (1987). *Wetland Evaluation: Methodology Development and Pilot Area Selection*. Report No. 1, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Bardecki, M.J. (1988) *An Application of Willingness-to-Pay, Opportunity Cost and Cumulative Impact Methods to Greenock Swamp, Ontario*. Report No. 3, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Bardecki, M.J. (1989). *Synthesis of Pilot Study Results*. Report No. 6, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Bond, W.K., M.J. Bardecki, K.W. Cox and E.W. Manning. (1988). *Wetlands are Not Wastelands: Interim Report*. Report No. 2, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Ferguson, A., G. Holman and R. Kistritz. (1989). *Application of Wetland Evaluation Methods to the Cowichan Estuary, British Columbia*. Report No. 4, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Stokoe, P., J. Roots and B. Walters. (1989). *Application of Wetland Evaluation Methodologies to the Minudie Dykelands, Nova Scotia*. Report No. 5, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.

Young, D.A. and J.P. Thompson. (1990). *Prairie Pothole Wetlands: Functions and Evaluation*. Report No. 7, Wetlands are Not Wastelands Project, Wildlife Habitat Canada and Environment Canada, Ottawa.