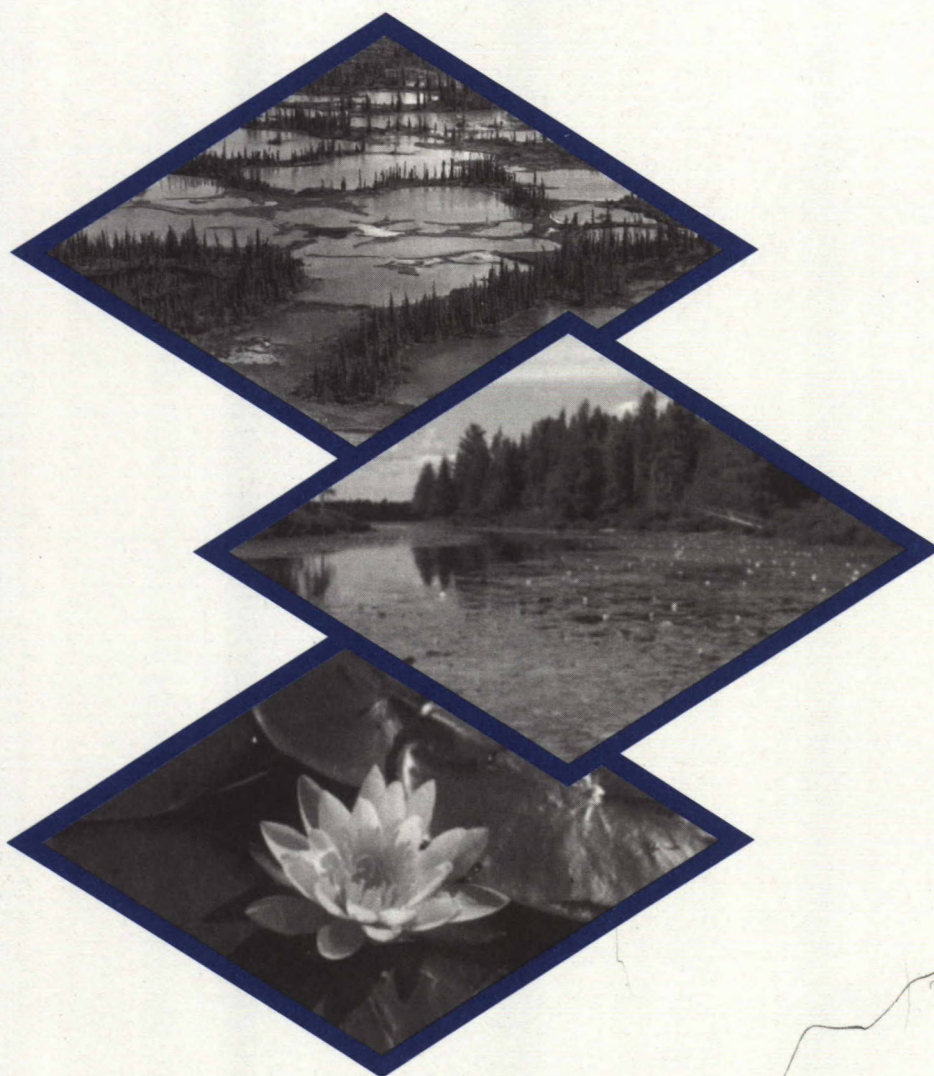


Wetlands environmental assessment guideline



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Wetlands environmental assessment guideline

By Robert Milko

Biodiversity Protection Branch
Canadian Wildlife Service
Environment Canada

1998

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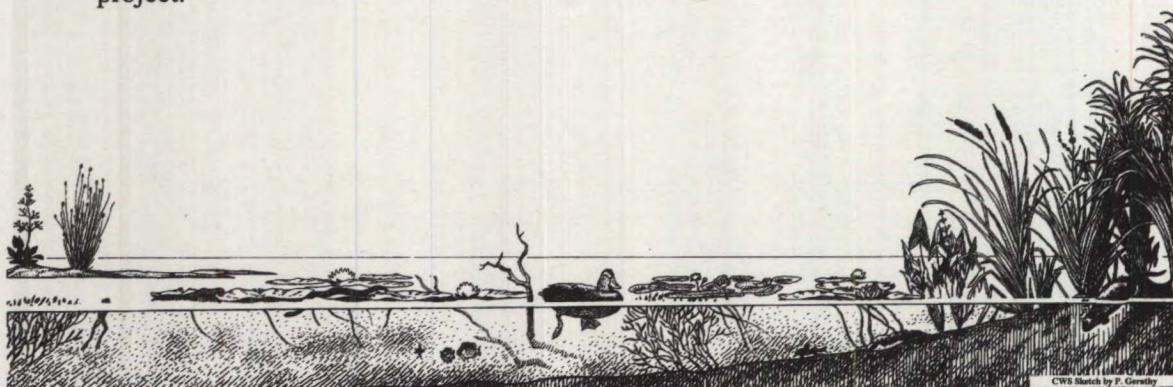


Introduction

The following guideline has been developed to identify for proponents of projects the types of information and analyses that Environment Canada would expect in the wetlands section of an Environmental Impact Statement (EIS). The guideline has been developed to be consistent with *The Federal Policy on Wetland Conservation* (Government of Canada 1991), referred to herein as the federal policy; the *Implementation Guide for Federal Land Managers* (Lynch-Stewart et al. 1996), called the implementation guide; and the *Canadian Environmental Assessment Act* referred to as CEAA.

It has been prepared to promote best practices for environmental assessments under CEAA. It should therefore be followed when a proposed project is expected to have an impact on a wetland under federal jurisdiction, or to have an impact on a nonfederal wetland while at the same time triggering an environmental assessment under CEAA. As well, it should be followed when Environment Canada is involved in the review of an environmental assessment of another jurisdiction in which a proposed project would have an effect on a wetland. Its use will facilitate a more standardized approach to assessing environmental impacts involving wetlands across Canada.

This guideline is predominantly conceptual in its approach, focusing on principles, rather than providing a detailed checklist of information and analytical requirements for the EIS. All the information may not be readily available, nor applicable to all projects, but in attempting to achieve best practices it is necessary to identify state-of-the-art information requirements and impact analyses. Information requests for EISs will therefore change through time as new information becomes available and environmental circumstances and environmental assessment practices change. Therefore, the guideline should not be regarded as either exhaustive or restrictive, nor would it preclude the request for additional or different information for a particular project.





There is national and international concern for the conservation of wetlands given their important ecological roles and in recognition of past and present stress on wetlands from human activities. As a result of this concern, Canada has joined with other nations in a number of international endeavours such as the Ramsar Convention and the North American Waterfowl Management Plan, whose objectives are the conservation and enhancement of wetlands.

Although wetland conservation in Canada is a shared federal, provincial, and territorial responsibility, the federal government has a particular interest. The preservation of wetland integrity is critical to federal responsibilities for maintaining the quality of the environment, migratory bird populations, inland and ocean fisheries, and international and transboundary resources such as water and wildlife.

The federal government views its role in wetland conservation as a partner with other governments and the private sector, while reflecting the national interest. It intends to lead by example and is committed to assisting national efforts in wetland conservation through models, tools, and expertise and by improving knowledge of Canada's wetlands. This environmental assessment guideline is one tool that can be used to fulfill the federal government's role.

The approach promoted by this guideline blends the focus on wetland functions of the wetland policy and the implementation guide with the ecosystem component approach to environmental assessment as outlined in CEAA. A functional approach helps elucidate the linkages between components and assists in developing an integrated approach to environmental assessment, also a goal of CEAA. It is assumed that those using this guideline have experience with the ecosystem approach to environmental assessment. Therefore, more emphasis will be placed on the functional approach to analyzing impacts on wetlands. Addressing functions and values, in addition to ecosystem components, will facilitate the application of No Net Loss principles and result in the least impact on wetland ecosystems. A more complete description follows.

The federal policy's objective is

to promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future (Government of Canada 1991, p. 7).

Supported by seven goals (see Appendix 1), the federal policy follows a hierarchical approach to understanding and addressing wetland conservation. It does so by focusing on ecological processes (functions) and their derived values. This is

consistent with most environmental assessment processes including that of CEAA, which assesses the direct environmental effects on ecosystem components and also considers the indirect, socioeconomic effects.

Also, as required in CEAA, an environmental assessment must address impacts in an integrated manner. Therefore, in the case of an environmental assessment involving wetlands, the links between the wetland functions, their derived values, and the components of the ecosystem must be considered holistically. An impact on one function or ecosystem component can, and usually will, affect others. Similarly, when mitigation measures are applied, an understanding of their effects on nontarget components or functions must be evaluated. As stated in the guiding principles to the federal policy,

wetlands and wetland functions are inextricably linked to their surroundings, particularly aquatic ecosystems, and therefore wetland conservation must be pursued in the context of an integrated systems approach to environmental conservation and sustainable development (Government of Canada 1991, p. 7).

The federal policy holds No Net Loss of wetland functions as its target for conservation of wetlands. Similarly, this guideline emphasizes the need for environmental assessments to ensure every effort has been made on the part of the proponent to prevent loss of wetland functions.

According to CEAA, the federal policy, and generally accepted environmental assessment practices, a proponent is obliged to mitigate all possible impacts. The implementation guide identified a sequence of mitigation alternatives that is outlined in the Mitigation section of this guideline. In developing a project proposal and preparing an EIS, a proponent must be able to demonstrate that this hierarchical sequence of mitigation alternatives (avoidance, minimization, and as a last resort, compensation) has been followed. Considering our limited understanding of wetland functions, as well as our limited capacity to restore or create wetlands, avoidance is the key step in the mitigation process and the best way to ensure No Net Loss of wetland functions.



Information requirements

This section provides both the contextual and more specific requirements for the information that should be in an EIS addressing potential environmental effects of a project on wetlands.

1. Context

The environmental assessment should be conducted in an ecosystem context. The wetland functions and important ecosystem components must be determined at the outset, because this will form the basis for the baseline information requirements. Consideration should be given to the fact that ecological processes and ecosystem components are inextricably linked within and between wetlands and surrounding areas both above and below ground. It is important to recognize and identify these linkages, such as the relationship of the recharge area to the potentially affected wetland, to ensure that the impact area is properly defined. It is also important to recognize that the effects on one function or component of the ecosystem can indirectly affect other functions or ecosystem components.

When gathering or compiling baseline information, proponents should give special consideration to information related to "key" wetland functions or ecosystem components. Key functions or components are those that substantially contribute to the integrity of the wetland ecosystem, are important in a local, regional, or national context, or can be used as indicators of the direct or indirect effects on other functions or components of the ecosystem.

Quantification provides the basis for more accurate prediction of impacts and selection of mitigation

measures; it also facilitates objective monitoring. Therefore, during the planning and conduct of an environmental assessment, particular attention should be paid to the collection and presentation of good, scientific baseline data where parameters that could be affected by the proposed project are quantified.

2. Specific information

The information required to conduct an environmental assessment for wetlands will depend, in part, on the scale of the proposed project or activity and on the projected degree of impact; for example, whether net loss of wetland functions is predicted. The regional environmental assessment practitioner of the Environmental Conservation Service of Environment Canada (ECS/EC) can provide guidance on how to obtain the specific information required and may be able to identify existing information sources to assist in carrying out the environmental assessment. The information identified below is generally required for an understanding of the potential impacts of a proposed project.

- A complete project description including engineering details should be provided. This information should be provided or discussed at the earliest stage of planning to allow for modification of the project design prior to major commitments by the proponent.
- The geographic boundaries of the environmental effects of the proposed project must be identified (referred to hereafter as the impact area). This includes the wetland and the geographic extent of the ecological functions and ecosystem components that could potentially affect the

wetland and be affected by the proposed project. It is critical that the impact area be agreed to by the proponent and environmental assessment practitioners early in the planning stage.

- A description of the potentially affected wetland(s) and impact area will be required. The description must address the terrain, biological settings, and land use in the area. Particular attention must be paid to surface and subsurface water and nutrient regimes and flows (locations of inflow and outflow points, seasonal volumes, and regularity), in a context of the broader hydrological regime or watershed in which the impact area is located. Factors affecting the water regime and flows can include, but are not limited to, surface and subsurface materials, soils, permafrost, and the position of the wetland in the surrounding landforms.
- Maps or GIS systems that accurately locate the impact areas and baseline information should be provided at the same scale as the engineering plans to allow for overlaying of maps. Maps should contain UTM coordinates or other identifying parameters.

Wetland functions can be complex; a complete understanding of all the ecological processes that contribute to a functional ecosystem is seldom available. Nevertheless, researchers have identified specific functions of wetlands that can be used to predict the extent of impacts of a proposed project.

The following list of questions grouped under function and value headings was derived in large part from the *Wetland Evaluation Guide* published by the North American Wetlands Conservation Council (Bond et al. 1992). The list is designed to help the proponent identify issues and parameters to consider when gathering baseline data, determining potential effects of the proposed project, and designing mitigative measures. An examination of potential impacts on functions and values implies

that the ecosystem components that will be impacted will also be identified.

a) Hydrological functions: contribution of the wetland to the quantity of surface water and groundwater

- Does the wetland play a prominent role in the hydrology of the watershed?
- Does the wetland contribute to the recharge of local or regional water supplies or their aquifers?
- Is the wetland used as a water supply (e.g., rural, urban, commercial, agricultural)?
- Does the wetland provide flow augmentation to users due to a headwater position in the catchment basin?
- Does the wetland provide flood protection benefits?
- Does the wetland provide erosion control?
- Does the wetland dampen tidal or lake shoreline fluctuations?

b) Biogeochemical functions: contribution of the wetland to the quality of surface water and groundwater

- Does the wetland receive pollution of a type amenable to amelioration by wetlands or is it used as a form of sewage treatment?
- Does the wetland provide storage for agricultural runoff?
- Does the wetland provide for containment or immobilization of toxics contained in surface runoff or discharge flow? If the flow or biogeochemical balance were to be modified, could the wetland release stored contaminants?
- Does the wetland provide for sediment flow stabilization?
- Does the wetland have nutrient levels that support wildlife populations or does it provide a discharge of value to downstream ecosystems?

c) Habitat functions: terrestrial and aquatic

- Are any species present that are designated at risk by relevant authorities (for example, the Committee on the Status of Endangered Wildlife in Canada [COSEWIC])?
- Does the wetland provide habitat(s) for: mammals, birds (see *Migratory birds environmental assessment guideline* — Milko 1998b), reptiles, amphibians, molluscs, crustaceans, invertebrates, fish, or plants? Which habitats in the wetland are critical or of special value for these species?
- Does the wetland support animal or plant species that are regionally unique or in unusual abundance? What features of the wetland are responsible?
- Are there species that depend on wetland or upland habitat for any part of their lifecycles?
- Does the wetland and its associated vegetation protect natural shorelines?

- What effects will natural environmental factors such as drought and flooding have on the wetland habitat?

d) Ecological functions: role of the wetland in the surrounding ecosystem

- Does the wetland support an extensive ecosystem complex including uplands?
- Does the wetland form an integral part of an important water drainage system?
- Is the wetland part of a wetland complex (several wetlands of different types) whose integrity is a necessary habitat requirement for some species?
- Does the wetland have high productivity relative to other wetlands of the same type and in the same region?
- Does the wetland provide a good representation of biological diversity?
- Is the wetland considered an important representative of its type?
- Are there few remaining natural, nonimpacted wetlands of this type in the region?

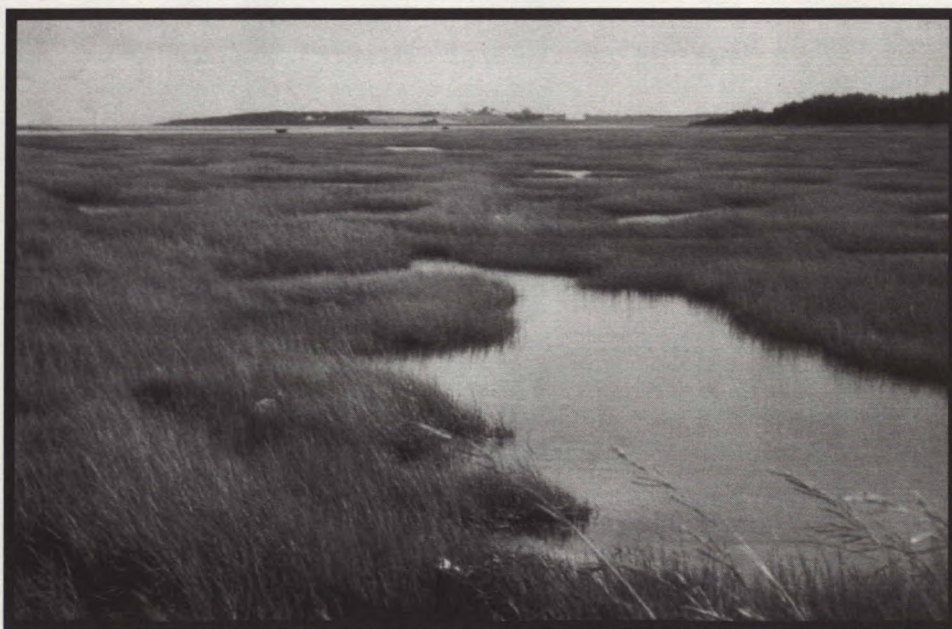


Photo: Clay Rubec

- Does the wetland contain, or owe its existence to, or is it a part of, or ecologically associated with a geological feature that is an excellent representation of its type?
- Will fragmentation of a wetland complex occur, or will there be a new linkage with other habitats that could result in the invasion of alien species, competitors, predators, etc.?
- Has a regional threshold been reached where wetland ecosystems for the entire region will be compromised by further degradation?

e) Social/cultural/commercial values

- Does the wetland form part of the historical/cultural heritage of a regional or local population?
- Does the wetland contain archaeological or paleontological resources?
- Does the wetland form part of a native traditional use area?
- Are there subsistence or commercial harvesting activities or opportunities, such as trapping, or gathering wild rice, cranberries, crabs, or oysters?
- Are there other commercial activities or opportunities, such as extracting peat or sodium sulfate?
- Does the wetland provide habitat (e.g., spawning or nursery habitat) for species fished commercially?

f) Aesthetic/recreational values

- Is the wetland visible from a provincial or territorial highway or a designated scenic highway, road, or passenger railroad?
- Is the wetland an important sightseeing locale or does it add to the visual diversity of the landscape?
- Does the wetland provide a base for viewing or photographing wildlife?

- Does the wetland provide opportunities for boating or other recreational activities?
- Does the wetland provide opportunities for recreational hunting or fishing?

g) Education and public awareness

- Is the wetland used for scientific research?
- Is the wetland used for educational and interpretation purposes?
- Does the wetland exist close to a large urban population, and how many visitors per year use the wetland?
- Are there policies/programs to support conservation/restoration of the wetland?
- Does the wetland provide for easy public access? Could the project provide for access that would not negatively affect the wetland's functions?

h) General

- Is the wetland ranked high in accepted evaluation systems?
- Is the wetland a site of special public interest or a unique national, provincial, or regional resource? For example, does the wetland have any special designation such as a Ramsar site, Western Hemispheric Shorebird Reserve Network (WSHRN) site, Migratory Bird Sanctuary, National Wildlife Area, or special management status (e.g., is it secured through partnerships such as the North American Waterfowl Management Plan joint ventures)?

3. Wetlands in managed forests

Other information may be required when the wetland is located in a managed forest. Examples of issues are:

- Will harvesting occur in basin swamps and tree fens, and is "watering up" expected?
- Will roads be needed in the wetland area or will winter logging, hauling, and storage suffice?

- Are there plans to drain peatlands?
- Is there a tree-cover-border around the wetland?
How wide is this habitat/buffer?
- Is there a concern with siltation or slumping into the wetland?

Depending on the type and extent of the wetland and the functions that could be affected, there may also be special requirements for forest information, particularly with respect to the forest as habitat for migratory birds (see *Environmental assessment guideline for forest habitat of migratory birds* — Milko 1998a). This potential need is best determined in consultation with the local/regional ECS/EC environmental assessment practitioner.

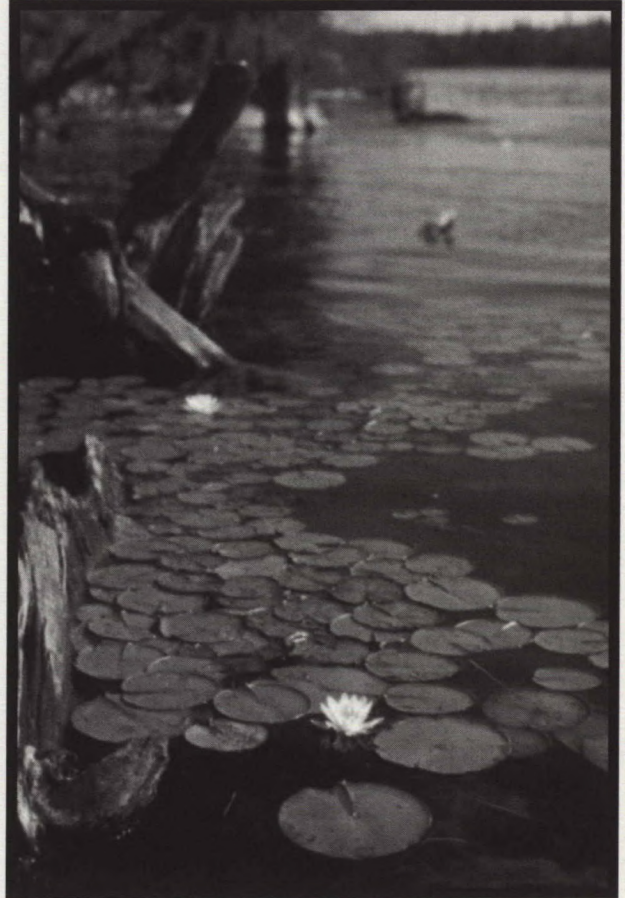
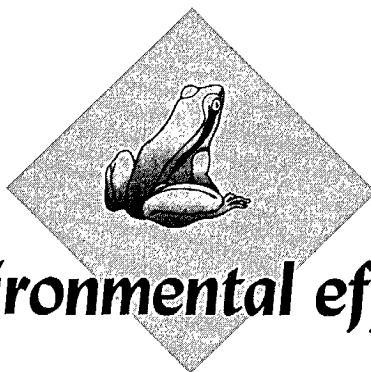


Photo: Robert Milko



Environmental effects

A careful assessment of the environmental effects of the proposed project must be undertaken prior to consideration of mitigation. It must be determined if any of the functions, components, and linkages of the wetland ecosystem that were identified in the baseline information section would be affected by the proposed project. The extent, both spatial and temporal, and the degree (quantified where possible) of the effects should be outlined in the environmental effects section of the EIS. Although at times it will be easier to discuss the effects function by function or component by component, recognition of the complex interactions in ecosystems should constitute the framework for the analysis and presentation of the information.

The types of factors that contribute to environmental effects will vary depending on the project and the wetland type and ecosystem that is potentially affected. Additionally, the effects will depend on the intensity, duration, timing, and frequency of impacts. Cumulative effects must also be considered. Tables 1 to 3 provide examples of the sorts of effects projects have on wetland functions.

A proponent who tries to classify the effects, for example as negligible, minor, major, or significant, and either positive or negative, must present explanations and justifications for the ranking system and designation of impacts. Quantification of environmental effects provides a good basis for determining the degree of impact. In particular, comparisons to similar wetlands in similar ecosystems provides an opportunity to examine effects in a relative (scientifically controlled) manner (see Monitoring section of this guideline).

1. Cumulative effects

CEAA specifically requires an environmental assessment to consider the cumulative environmental effects of a project. These are effects

that are likely to result from the project in combination with other projects or activities that have been or will be carried out (CEAA ss.16(1)(a)).

Because cumulative effects encompass changes resulting from past, proposed, and future projects, the dynamic nature of ecosystems needs to be considered. More specifically, the baseline information should describe the environment without any development, and elucidate and quantify the natural changes inherent in the ecosystem. For previously developed locations, the use of unmodified control sites may provide approximate baseline information.

A wetland under consideration in an environmental assessment may have already been affected by projects. An understanding of how the ecosystem responded to stresses in the past may be useful in the prediction of effects of the proposed project or a particular stress associated with the proposed project. Cumulative effects should be considered in a regional context.

2) Mitigation

The federal policy outlines the approach to mitigation policy that should be followed when a proponent plans a project that would affect wetlands and conducts the requisite environmental assessment. In particular, the federal policy describes a strict sequence of mitigation alternatives — avoidance, minimization, and compensation —

Table 1**Generally expected effects of various stresses on water quality functions of wetlands
(from Leibowitz et al. 1992)¹**

Enrichment	Increase in denitrification rate, sediment stabilization, and biological uptake and processing; may depress the latter if extreme or chronic
Organic loading	Reduces biological uptake/processing, especially at high loadings or if associated with acidification; increases sedimentation and denitrification rates under moderate loadings; enhances mobilization of some substances through oxidation effects
Contamination ²	Variable effects, depending on the specific contaminant and other factors; can depress denitrification, biological uptake/processing, and photosynthesis
Acidification	Usually depresses denitrification, biological uptake and processing, and perhaps photosynthesis; effects on chemical adsorption depend on the chemical, but acidification usually results in increased mobility of heavy metals
Salinization	May depress denitrification, biological uptake, and photosynthesis and enhance adsorption of some chemicals; response depends partly on the degree to which the system is adapted to salinity
Sedimentation/soil compaction	Depresses biological uptake, processing, and photosynthesis, and may reduce hydrologic residence time; other effects are variable
Turbidity/shade	Reduces photo-oxidation of some contaminants, and usually depresses denitrification, photosynthesis, and perhaps biological uptake
Vegetation removal	Reduces sedimentation, sediment stabilization, photosynthesis, biological uptake/processing, and perhaps denitrification. Sediment removal capacity of early successional forested wetlands may increase.
Thermal warming	Increases rates of most chemical and biological functions up to a point
Dehydration	Concentration of inorganic chemicals increases as dehydration proceeds; complete drawdown temporarily remobilizes many substances, especially organics and phosphorus, but may renew wetland adsorption capacity for some substances; effects on other water quality functions are variable.
Inundation	May increase sedimentation and decrease biological uptake and processing, and photosynthesis; effects on other functions are variable
Fragmentation	Increasing the distance between wetlands could reduce the effectiveness of coupled functions important to water quality

¹ This is intended as a general guide, and effects may differ depending on wetland type and the timing, duration, extent, and intensity of the stress.

² From heavy metals and pesticides.

Table 2

**Generally expected effects of various stresses on habitat functions of wetlands
(from Adamus and Brandt 1990, as cited in Leibowitz et al. 1992)¹**

Enrichment and organic loading	Initial enrichment increases production and within-wetland biotic diversity, but prolonged or extreme enrichment results in increased dominance of a few invasive species, decreased species richness, diminished wetland structural diversity, decreased production, and, in some regions, succession to upland vegetation
Contamination ²	All habitat functions are generally impaired
Acidification	Results in diminished native biodiversity and production
Salinization	In freshwater wetlands, usually results in diminished species richness (especially of woody species), but surviving species may be unique and thus contribute disproportionately to overall regional diversity
Sedimentation/soil compaction	Diminishes species richness as a result of reduced light, smothering, etc.; however, moderate amounts of sediment can increase production of some woody plants in floodplains and can increase habitat in deeper depressions by providing additional shallow substrate for colonization
Turbidity/shade	Variable effects; can diminish habitat suitability by reduced plant biomass, but can benefit some species by providing shelter from predation and extreme heat
Vegetation removal	Diminishes habitat space; scattered thinning of dense stands can increase species richness and spatial heterogeneity; selectively benefits some species but detrimental to many others
Thermal warming	Reduces species richness, but surviving species may be unique and thus contribute disproportionately to regional diversity if warming is local
Dehydration	Temporary dehydration, if infrequent and brief, can reinvigorate nutrient cycling in wetlands and thus increase primary production; effects of partial drawdowns are variable; drawdowns can result in invasion by undesirable weed species, such as common reed or purple loosestrife; permanent dehydration results in conversion to upland habitat
Inundation	Can increase habitat space for aquatic communities (particularly if the result is an interspersed of wetland vegetation and open water), facilitate dispersal of isolated aquatic populations, increase bank erosion, and dilute contaminants; contaminants, suspended sediment, plant material, and nutrients can also be reintroduced from newly flooded areas
Fragmentation	Increasing the distances between wetlands usually reduces regional biodiversity, although invasion by aggressive nonnative species can be similarly reduced

¹ This is intended as a general guide, and effects may differ depending on wetland type and the timing, duration, extent, and intensity of the stress.

² From heavy metals and pesticides.

Table 3

**Generally expected effects of various stresses on hydrologic functions of wetlands
(from Leibowitz et al.1992)¹**

Sedimentation/soil compaction	Reduction in storage, infiltration, and groundwater recharge causing an increase in surface runoff
Vegetation removal	Reduction in interception, condensation, evapotranspiration, and surface roughness (runoff resistance), and an increase in runoff velocity and groundwater discharge
Dehydration	Reduction in groundwater exchange (sometimes) and an increase in evapotranspiration (during early vegetational succession); these effects are especially likely where dehydration results from channelization or artificial drainage
Inundation	Usually increases infiltration and recharge within the wetland, but may convert nearby wetlands from recharge to discharge areas or vice-versa
Fragmentation	Can reduce groundwater recharge and discharge in remaining wetlands

¹ This is intended as a general guide, and effects may differ depending on wetland type and the timing, duration, extent, and intensity of the stress.

with clear criteria and defined outcomes needed to implement the No Net Loss requirements.

Mitigation under the federal policy is consistent with the CEAA definition for mitigation:

“mitigation” means, in respect of a project, the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means; (CEAA ss.2(1)).

The mitigation sequence is outlined in Table 4. It is not possible to identify all the strategies or all the techniques for their implementation, due to the variety of projects and wetlands and the development of new strategies for mitigation as our understanding of ecosystems and management techniques changes. Strategies appropriate to the project should be identified in consultation with the regional environmental assessment practitioner at the earliest possible stage of planning.

When proposing a mitigation technique, proponents should consider the effects of the technique on nontarget functions and components of ecosystems. For example, creating habitat for waterfowl, commercial fisheries, or other harvestable species should not be at the expense of other biodiversity conservation needs.

Restoration can be viewed as part of the overall mitigation process and should be considered in terms of cumulative effects, particularly if a wetland's function is degraded from past projects or activities.

Refer to *Conserving wetlands in managed forests* (Sheehy 1993) and *Wetlands and woodlots* (Twolan-Strutt 1995) for an introduction to mitigation techniques for projects dealing with wetlands in managed forests.

Compensation requirements would be determined with the regional environmental assessment practitioner. (Discussion regarding mitigation and

Table 4

**Mitigation sequence for an environmental assessment involving wetlands
(summarized from Table 1 in Lynch-Stewart et al. 1996)**

- 1) **Avoidance** The best and least disruptive approach to mitigation of environmental effects is avoidance. Avoidance refers to the elimination of adverse effects on wetland functions by altering the siting or modifying the design of a project. The fundamental question is: how can any of the potential adverse environmental effects be avoided? Avoidance is recommended in all wetland conflict situations, but is particularly prescribed under the following circumstances:
- (a) on or near wetlands designated as ecologically or socioeconomically important to a region;
 - (b) in areas where wetland losses have been severe;
 - (c) for projects with feasible alternatives; and
 - (d) when significant adverse effects on wetland functions cannot be mitigated or justified; that is, projects assessed as having significant adverse effects (as defined by CEAA) on wetlands, that cannot be mitigated (including consideration of the capacity for regeneration of wetland functions).

Avoidance of environmental effects on all ecosystem components, wetland functions, and derived values must be considered. Particular attention will need to be given to issues identified in the Environmental Effects section.

- 2) **Minimization** refers to the reduction or control of adverse effects on wetland functions through project modification or implementation under special conditions. Minimization should be practised after attempts to avoid effects have been undertaken.
- 3) **Compensation** refers to the replacement of unavoidably lost wetland functions, through enhancement or rehabilitation of existing wetlands with similar functions, or, as a last resort, creation of new wetlands. Compensatory mitigation should be practised when and only when:
- (a) all possible avoidance and minimization measures have been applied;
 - (b) the project justifies adverse effects or diminished functions and all possible mitigation has been applied; and,
 - (c) the proponent provides evidence that the functions can be effectively replaced when, where, and to what or to whom they are important.
-

compensation can be found in Cox and Grose, 1998.)

3. Residual effects

The proponent should describe what environmental effects would remain after avoidance and minimization measures have been conducted. If the proponent undertakes to classify the effects (e.g., as negligible, minor, major, or significant; and either

positive or negative), explanations and justifications for the designation of impacts must be presented.

In an environmental assessment, particularly under CEAA, residual effects will play a large role in the determination of whether the adverse environmental effects are acceptable or whether they are significant enough to require mediation, panel review, or nonapproval. They will also assist in determining whether compensation may be an

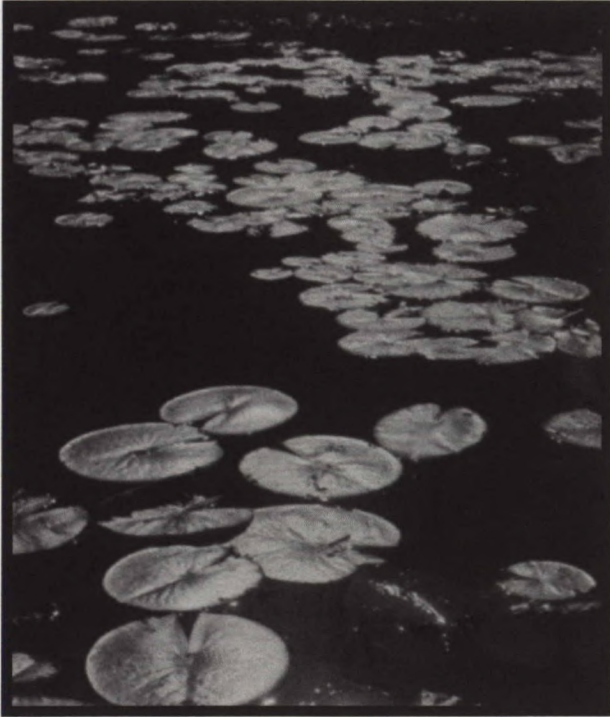


Photo: Robert Milko

predictions. Monitoring of sites that contain wetlands and functions similar to those that are found in the proposed impact area is encouraged because data from this control site helps investigators to determine which effects are the result of the project and which are the result of natural variation. Monitoring requirements may be imposed as a condition of project approval.

appropriate approach to addressing the residual effects.

4) Monitoring

Monitoring regimes should be proposed by the proponent, but particular methods may be requested by Environment Canada depending on the project and impact area. Monitoring determines whether impacts are more than predicted, allows appropriate changes in mitigative measures, and determines the appropriateness of compensation involving wetland (function) exchanges to ensure no net loss of wetland function.

Any monitoring regimes proposed by the proponent should be described. Monitoring, in general, should be conducted at specified intervals to determine the range of variation. Monitoring should also be conducted at the limits of natural variation that could be expected for the area to determine the effects of the environment on the project and impact

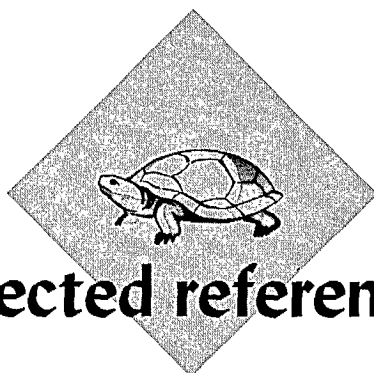


Wetland

The federal policy defines a wetland as land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kind of biological activity that are adapted to a wet environment. Wetlands include bogs, fens, marshes, swamps, and shallow waters (usually 2 m deep or less) as defined in *The Canadian Wetland Classification System* (National Wetlands Working Group 1997).

Wetland functions

Wetland functions include the natural processes and derivation of benefits and values associated with wetland ecosystems, including economic production (e.g. peat, agricultural crops, wild rice, commercial fisheries/shellfish, peatland forest products), wildlife (including fish) habitat, organic carbon storage, water supply and purification (groundwater recharge, flood control, maintenance of flow regimes, shoreline erosion buffering), and soil and water conservation, as well as tourism, heritage, recreational, educational, scientific, and aesthetic opportunities.



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Appendix

Goals of the Federal Policy On Wetland Conservation

1. Maintenance of the functions and values derived from wetlands throughout Canada
 2. No net loss of wetland functions on all federal lands and waters
 3. Enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels
 4. Recognition of wetland functions in resource planning, management, and economic decision-making with regard to all federal programs, policies, and activities
 5. Securement of wetlands of significance to Canadians
 6. Recognition of sound sustainable management practices in sectors such as forestry and agriculture that make a positive contribution to wetlands conservation while also achieving wise use of wetland resources
 7. Use of wetlands in a manner that enhances prospects for their sustained and productive use by future generations
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Source: Government of Canada 1991, p. 7.