Wetland Ways

2

Interim Guidelines for
Wetland Protection and Conservation in British Columbia

March 2009

Chapter Two

General Guidelines

Wetland Stewardship Partnership

These interim guidelines will be updated using experience from pilot testing and feedback from user groups. If you would like to comment on these guidelines, please send your comments to: wsp@gov.bc.ca

Cover photos: Jenny Balke and Dave Polster

CHAPTER 2: GENERAL GUIDELINES

2.1. INTRODUCTION TO MANAGEMENT GUIDELINES

"Wetlands filter and recharge our freshwater, store greenhouse gases, help prevent flooding and provide habitat for numerous species. We also benefit economically from wetlands – in 2003, the value of wetlands to Canadians was estimated at $20 billion annually. Wetlands are more beneficial to Canadians, both environmentally and economically, if they are left intact rather than drained or destroyed."

Ducks Unlimited Canada, 2006.

Concerns from activities on or near wetlands and their associated riparian areas include:

- Changes to vegetation, affecting *wildlife*[1] habitats;
- Disturbance of wetland fauna;
- Changes to water quantity that alters the fundamental nature of the wetland; and
- Changes to water quality that alters its suitability for wildlife.

PHOTO: SARMA LIEPENS

There are a variety of laws and regulations that govern activities on or near wetlands. The legislative framework that provides for general and specific management of activities on private and Crown Lands in British Columbia is both complex and broad (see SECTION 2.2: LEGISLATION).

However, legislation is only one of a number of tools on a continuum of approaches that are intended to achieve a specific result(s) on the ground. Additional tools that support legislated goals include policy, environmental monitoring, training, and the development of guidance documents (best management practices, guidelines, handbooks) that provide guidance and assistance in protecting and maintaining environmental values while continuing to operate in a safe and cost effective manner. *Wetland Ways* provides such advice and guidance.

Adherence to guidance documents is not mandatory. However, following these guidelines provide a number of benefits to the operator:

- Opportunities to manage operations in a flexible manner;

[1] *Definitions* can be found in the GLOSSARY.

Due diligence – taking all reasonable precautions to prevent or avoid a non-compliant incident from occurring. This standard requires that a person take all the care which a reasonable person might have been expected to take in all the circumstances or, in other words, be in no way negligent.

- Protection of environmental features and functions. These can bring a variety of benefits including ecological services such as management of stormwater and groundwater recharge (see CHAPTER 1); and
- Following accepted guidelines when carrying out activities supports a 'due diligence defence' if there are inadvertent environmental impacts that could lead to enforcement penalties.

The legislation and guidelines support the notion of shared stewardship. This is the view that achieving sustainability depends on the collective knowledge, commitment, and actions of individuals, organizations including industries and stakeholders, communities, and all levels of government.

2.1.1. Wetland Protection and Management

The simplest—and often cheapest—way to protect wetland values is to set aside the wetland and a suitable buffer area under some form of protected status, whether on Crown or private land. The appropriate protection option will depend on ownership of the property, the purpose(s) of protection, on-going responsibility for management and whether or not public access will be allowed. Some of the legal protection options are outlined in APPENDIX 2.1: LEGAL PROTECTION TOOLS.

However, it may not always be practical to set land aside in its entirety, especially where that land is also being used for other purposes such as agriculture, forestry, or recreational use. These wetland guidelines apply where complete protection is not an option, and there is a need to balance land use activities with wetland values. This chapter provides advice that applies to most land use activities, but there are several other chapters dealing with specific sector guidelines:

3. WETLAND GUIDELINES FOR AGRICULTURE

4. WETLAND GUIDELINES FOR GRAZING

5. WETLAND GUIDELINES FOR FORESTRY

6. WETLAND GUIDELINES FOR MINING

7. WETLAND GUIDELINES FOR OIL & GAS

8. WETLAND GUIDELINES FOR RECREATION

9. WETLAND GUIDELINES FOR TRANSPORTATION AND UTILITY CORRIDORS

10. WETLAND GUIDELINES FOR URBAN AND RURAL LAND DEVELOPMENT

Where wetland function has already been impaired, it is possible to **enhance, restore or create** wetland processes and values. This is generally more complex and expensive than simply protecting the wetland in the first place. More information is provided in:

11. WETLAND ENHANCEMENT, RESTORATION AND CREATION

For all activities, it is important to monitor results and make adjustments to management regimes as needed. More information is provided in:

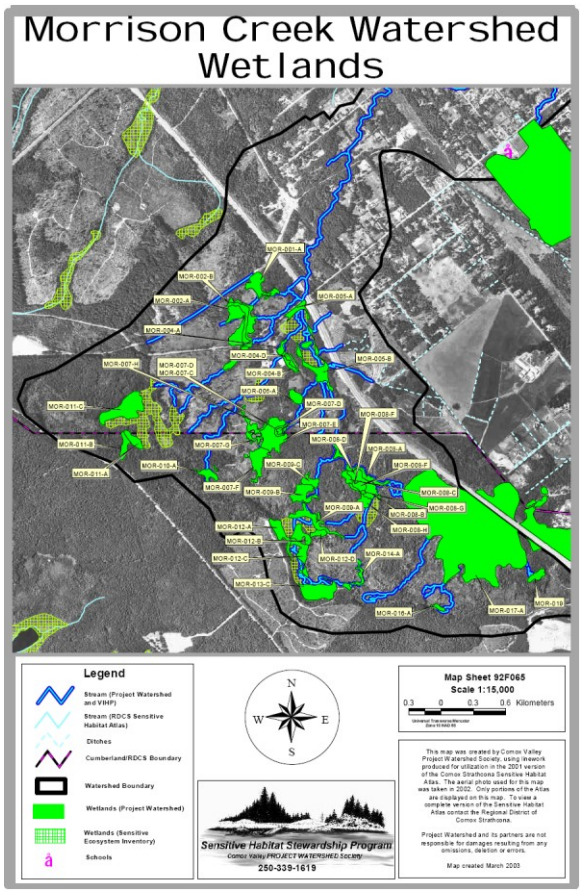
12. WETLAND MONITORING AND REPORTING

As with all other chapters, this Chapter lists the relevant legislation, the management objectives, and suggested guidelines to follow. In many places hyperlinks are provided to external documents, the url for these links can be found in SECTION 2.4.6: REFERENCES.

Forested wetland. PHOTO: JUDITH CULLINGTON

2.1.2. The Watershed Context

Wetlands are very much influenced by their watershed. If upstream impacts on the watershed result in more (or less) water reaching the wetland from surface or groundwater sources, and/or there are significant changes in water quality, there may be significant impacts on the wetland, regardless of how carefully nearby activities are managed. It is important to understand the context within which the wetland is situated in order to make good management decisions.



Mapping the wetlands within their watershed context provide valuable information. This mapping was prepared by the Comox Valley Project Watershed Society, and forms part of the Regional District's Sensitive Habitat Atlas. IMAGE FROM HTTP://WWW.MORRISONCREEK.ORG/SHIM/APPENDIX_2/MORR_WETLANDS.PDF

WATERSHED HYDROLOGY

Signs of altered watershed hydrology include reduced flows during dryer periods, but increased flood peaks following precipitation. Impacts from these changes are beyond the scope of these guidelines, and should be addressed at the watershed level.

2.2. LEGISLATION

All B.C. legislation can be found at http://www.bclaws.ca/. Federal legislation can be found at http://laws.justice.gc.ca/.

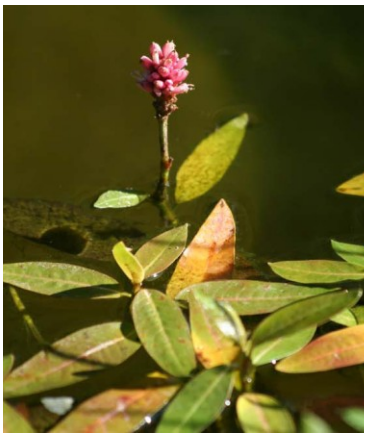
While the legislative agenda can seem overwhelming it should be remembered that only selected legislation or portions of legislation may apply to your activities. If you are uncertain how legislation may apply to your operations contact the appropriate provincial or federal agency.

Legislation that applies to activities on or near wetlands includes the following.

- *Water Act*: Part 9 of the *Water Act* governs all works in or about a stream. (The definition of 'stream' includes wetlands.)These works require an approval or notification, depending on the type of work being carried out and risk to the stream. The Act specifies routine activities (e.g., installation of clear-span bridges, installation or repair of a wharf or pier, replacement and maintenance of culverts and outfalls, temporary diversions around worksites, and minor maintenance of municipal utilities [water works]) that can be carried out without the need for a formal approval under the *Water Act,* so long as the work is carried out in compliance with the regulations, and notification is provided to the Ministry of Environment. Major works such as erosion protection, bridges with support structures, relocating streams, etc. require approvals. For more information see "Approval Application or Notification for Changes In and About a Stream Under Section 9 of the *Water Act* and Part 7 of the Water Act Regulations". Note that some works may also require approvals from Fisheries and Oceans Canada. The Groundwater Protection section (Part 5 of Water Act) protects wells/aquifers from contamination and affords some protection for wetlands that are groundwater-fed.
- *Fish Protection Act* and Riparian Areas Regulation: Regulates setbacks from streams and other watercourses that are fish-bearing, or have surface connections to fish-bearing waters. The Riparian Areas Regulation applies to the Georgia Basin and Southern Interior of the province. (Other communities may adopt this methodology if they choose.) Note that the Riparian Areas Regulation does not apply to the marine foreshore (including estuaries).
- *Wildlife Act*: Protects most vertebrates from direct harm or harassment, and regulates hunting and trapping.
  - Section 34 of the Act specifically protects birds and their eggs from possession, molestation or destruction; the nests of eagles, Peregrine Falcons, Gyrfalcons, Ospreys, herons, and Burrowing Owls year-round; and the nests of all other birds when the birds or their eggs are in the nest.

- ◊ Unless specifically authorized, it is an offence to 'disturb, molest or destroy' a beaver or muskrat's house or den, or a beaver dam (s.9).
- ◊ The Motor Vehicle Prohibition Regulation governs areas that are closed to vehicles (including ATVs[2] and snowmobiles) for some or all of the year.

- *Wildlife Amendment Act:* Allows the provincial government to list animals, fish, plants, or invertebrates as species at risk, and to define and protect the residence of a listed species at risk. Listing provides prohibitions against the killing, harming, harassing, importing, exporting, trafficking, possession, and transport of that species on both provincial Crown land and private land except as authorized by regulation, permit, or agreement. As of March 2009, the *Wildlife Amendment Act* has not been brought into force, and regulations to list species and prescribe residences have not been prepared.
- *Forest and Range Practices Act* : FRPA and its regulations govern the activities of forest and range licensees in the province. The statute sets the requirements for planning, road building, logging, reforestation, and grazing. FRPA maintains high levels of protection for forest values including watersheds and wildlife habitat, and creates efficiencies for both government and industry through streamlined planning processes.
- *Environmental Assessment Act*: Sets out procedures and requirements for review of major projects, which must undergo environmental impact assessment and obtain an environmental assessment certificate in order to proceed. Major groundwater extraction or water diversion projects may be reviewable under EAA. Legislation is managed by the Environmental Assessment Office.
- *Environmental Management Act*: Provides authority for the Ministry of Environment to set guidelines and standards, and provides protection for wetlands impacted by the deposit of waste into the environment. The Municipal Sewage Regulation controls the use of reclaimed water and identifies permitted uses, together with a code of practice.
- *Canada Fisheries Act*: Protects fish and fish habitat. The Act regulates the release of 'deleterious substances' into fish bearing waters and prohibits the 'harmful alteration, disruption and destruction' of fish habitat, defined as 'spawning grounds and nursery, rearing, food supply and migration areas on which fish depends directly or indirectly in order to carry out their life processes.' This Act applies only if the wetland in question is fish habitat.



Water smartweed.
PHOTO: SARMA LIEPENS

[2] All terrain vehicles

Do not alter fish habitat without approval.
PHOTO: ROBERT COX

- ◊ S. 35(1) prohibits alteration of fish habitat without approval. If the Department of Fisheries and Oceans (DFO) authorizes a project that will damage fish habitat, habitat compensation may be required.
- ◊ S. 36 (3) of the Act prohibits pollution of any water frequented by fish.

- *Canada Species at Risk Act* (SARA)*:* SARA provides for the legal protection of federally listed wildlife species and the conservation of their biological diversity. On federal land, it is an offence to:
  - ◊ Kill, harm, harass, capture, or take an individual of a listed species listed in of SARA;
  - ◊ Possess, collect, buy, sell or trade an individual of a listed species;
  - ◊ Damage or destroy the residence (e.g. nest or den) of one or more individuals of a listed species, including an extirpated species if a recovery strategy has recommended the reintroduction of that extirpated species.

  On private land, these prohibitions apply only to listed aquatic species, and migratory birds listed in the *Migratory Birds Convention Act, 1994* and also listed under SARA. For more information see the Species at Risk Public Registry.

2.3. OBJECTIVES

A shopping mall development on southern Vancouver Island was thought to have no impact on a nearby wetland. However the mall sits on an area that was part of the water source for the wetland, and the result has substantially altered the wetland hydrology and degraded the wetland ecosystem.

There are three primary objectives for the protection and management of wetlands:

- Protect and maintain habitats and species
- Protect and maintain water quantity
- Protect and maintain water quality

This can be achieved by:

- Knowing what you have (inventory and mapping) (see SECTION 2.4.1: WETLAND MAPPING, INVENTORY AND ASSESSMENT);
- Protecting wetlands with buffer zones (see SECTION 2.4.2: BUFFERS);

Minimizing impacts from nearby activities (see SECTION 2.4.3: PROTECTING HABITATS AND SPECIES, SECTION 2.4.4: PROTECTING WATER QUANTITY; and SECTION 2.4.5: PROTECTING WATER QUALITY as well as CHAPTERS 3 TO 10.

2.4. GUIDELINES

These management guidelines provide general advice as to how best to protect and conserve wetland values. Where complete protection is not an option and impacts cannot be completely avoided due to site configuration, economics or other considerations, they should be minimized through project modification to reduce the amount, intensity and duration of the impacts.

However, each situation is somewhat site-specific. Much will depend on the type of wetland, its size, its sensitivity, and the nature of the activities taking place. Proponents are encouraged to seek the advice of an *appropriately qualified professional* to help them determine best practices in their particular circumstance.

Wetland protection and conservation may involve costs—in determining best practices, in setting aside land that might otherwise be used, and in undertaking good practices to maintain wetland values. However, there are also benefits to be gained, including meeting the 'due diligence' test and avoiding penalties under the *Fisheries Act* or other legislation.

Ecosystem features are physical attributes that create many different types of habitat for different species. Examples include snags (standing dead trees), ground cover, and large woody debris in streams.

Ecosystem functions are processes that keep an ecosystem operating. Examples include infiltration of surface water, evapo-transpiration and nutrient cycling.

IDENTIFY THE WETLAND TYPE AND VALUES

- ☐ Identify the 'type' or 'class' of wetland that you are managing (e.g., fen, bog, swamp). See CHAPTER 1 for more information on wetland types.
- ☐ Determine the *features* and *functions* that the wetland currently provides or could provide with appropriate buffers, including wildlife habitat, groundwater recharge, and carbon sequestration.

IDENTIFY POTENTIAL IMPACTS ON THE WETLAND

- ☐ Identify any impacts that your proposed activities could have on the wetland. This includes effects from upland activities, impacts on water quantity and quality, impacts on wildlife movements, and impacts from increased human presence in the area.

Identify potential impacts on the wetland.
PHOTO: JUDITH CULLINGTON

Determine management objectives.
PHOTO: SARMA LIEPENS

- ☐ Identify other pressures on the wetland, such as likely impacts from development activities, climate change, invasive species, wetland succession processes, and sedimentation.

DETERMINE MANAGEMENT OBJECTIVES FOR THE WETLAND

- ☐ Determine management objectives for the wetland, such as
  - ◊ Protection of species at risk,
  - ◊ Maintenance of annual flooding/drying cycles, and
  - ◊ Repair or re-establishment of riparian areas.
- ☐ Develop a management plan that identifies who will be undertaking what actions to meet your objectives.

OBTAIN ALL NECESSARY PERMITS AND APPROVALS

- ☐ Ensure that you follow all legislative requirements (federal, provincial and local government) and obtain appropriate permits for any proposed activities. For example;
  - ◊ Obtain all necessary *Water Act* Approvals and Notifications before working in or around water;
  - ◊ Check local government bylaws and permitting processes for additional local restrictions and requirements; and
  - ◊ Consult with First Nations as appropriate.

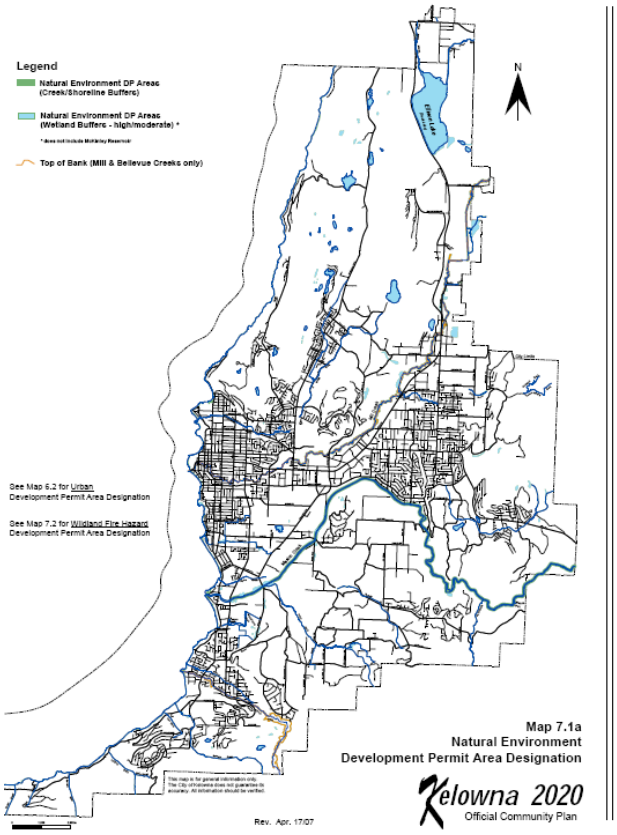
2.4.1. Wetland Mapping, Inventory and Assessment

You can't manage what you don't know.

The first step in wetland protection is to identify, map and classify (i.e., inventory) the wetlands.

Information at a watershed level is helpful in determining the location of the wetland of interest in relation to its watershed, and to better understand any upstream and downstream impacts that may have impacts on management decisions. At the watershed level, mapping of environmentally sensitive areas or wetlands is usually undertaken by senior or local governments, the land manager or a watershed management group.

Some watershed mapping will show only the general location of the wetland; other mapping may include additional information on the type of wetland, presence of species at risk, etc.



The City of Kelowna is mapping wetland habitats, gathering information such as wetland functionality rating, livestock use intensity rating, wetland community type, biodiversity index, vegetation, proximity to other wetlands and ecotone abundance. For more information see http://www.obwb.ca/fileadmin/docs/Kelowna.Progress.Web.pdf. MAP FROM HTTP://WWW.KELOWNA.CA/CM/PAGE440.ASPX

IDENTIFY EXISTING INFORMATION SOURCES

☐ Identify existing sources of information on wetland mapping. For example, wetlands may already have been mapped through a Sensitive Ecosystems Inventory, forest inventory or community environmentally sensitive areas mapping. Note the scale of the inventory and mapping—it may be that watershed-scale mapping will miss small but important wetlands. Also beware that watershed level surveys are not always as accurate as they might be, and site level surveys may also be required to verify the information.

WETLAND INFORMATION

Sources of wetland inventory include:

- The Community Mapping Network, providing online atlases from a variety of sources;
- Forest inventories;
- Local government habitat atlases;
- Watershed-Based Fish Sustainability Planning;
- Sensitive Ecosystems Inventories (Okanagan Valley from Vernon to Osoyoos, East Vancouver Island & Gulf Islands, and Sunshine Coast)

CONDUCT ADDITIONAL MAPPING AND INVENTORY AS NEEDED

- ☐ Wetlands should be mapped at a scale of between 1:10,000 and 1:20,000 for landscape level planning or at a scale appropriate for the management objectives. Provincial standards for inventory and mapping (such as Terrestrial Ecosystem Mapping and Sensitive Ecosystems Inventories) are provided by the Resource Information Standards Committee.
- ☐ Make the results of the mapping and inventory information available to other users, for example through a local government habitat atlas or in the Community Mapping Network.

Site-specific Surveys

Site-level mapping and inventory are necessary prior to many activities near wetlands. The level of survey detail required will depend on the sensitivity of the wetland and the nature of the proposed activity.

The goal of the wetland assessment is to provide sufficient information so that decisions can be made on a scientific basis, in the context of the surrounding area. It allows for the comparison of the relative values of the various wetland values on a site and its surrounding area so that decisions can be made that will minimize ecological degradation.

Conduct a preliminary site survey.
PHOTO: JUDITH CULLINGTON

More detail on site surveys is provided in *Develop with Care* (Appendix D). Four main stages are involved.

- **Preliminary site survey**: This step is to identify the presence or absence of wetlands. This preliminary survey includes a review of existing information, contacts with groups who may be familiar with the location and values of area wetlands, and a site inspection.
- **Bio-inventory**: This is done by an appropriately qualified professional and includes:
  - ◊ A detailed site inspection;
  - ◊ An evaluation of the environmentally valuable resources present;
  - ◊ An outline of options for avoiding or mitigating development impacts; and
  - ◊ An outline of restoration and enhancement opportunities.
- **Conservation evaluation**: This involves analyzing and interpreting the bio-inventory data, and assigning comparative ranks to the wetland and other values present. It ranks the site relative to provincial and regional scales, and enables the assessor to see how the conservation values of the environmentally valuable resources on the

Include a detailed site inspection by an appropriately qualified professional. PHOTO: DOUG BIFFARD

- site compare with one another. This can help decision-makers to design plans that preserve features of highest conservation value.
- **Impact assessment**: Provides the context needed to make land use decisions that minimize ecological degradation. The goal of an effective site assessment is to provide sufficient information so that decisions can be made on a scientific basis.

A full example of how a wetland might be evaluated for a particular project is provided in the Wetland Evaluation Guide.

2.4.2. Buffers

Introduction

Wetland buffers are upland areas adjacent to the wetland aquatic habitat. These areas may contain undisturbed natural habitat or have some level of disturbance caused by existing or past land uses. The purpose of establishing buffers is to protect wetland features and functions. While the terms 'buffers' and 'riparian areas' are often used synonymously, buffers may extend beyond the riparian area to ensure wetland features and functions are not significantly impaired.

Buffers around wetlands in B.C. are generally set through consultation and negotiation, based on best available information and current science. Buffer distances should reflect environmental concerns as well as operational and economic constraints. Given the different activities and pressures on the land base, buffer widths may vary widely for different user groups. These buffer numbers are reflected in guidelines or best management practices or in some cases are mandated through regulatory processes. These are the buffer numbers that are noted within the various chapters of this document.

The effectiveness of wetland buffers can be enhanced through watershed planning. Generally buffers will not be as effective where they are designed and implemented on a site-by-site basis. Wetlands and their buffers should be managed within the context of the overall watershed

EFFECTIVENESS OF WETLAND BUFFERS

Information on the effectiveness of current wetland buffers in British Columbia is generally anecdotal in nature. To date, there has been no scientific assessment to determine if the buffers are achieving their intended objectives. Wetland buffer implementation and effectiveness on Crown forest lands is an issue that will be examined by the Forest and Range Evaluation Program established to monitor results under the *Forest and Range Practices Act*. However, no date has been established for this work.

and the potential impacts of the ongoing and future land use activities within the watershed. Mitigation of high intensity uses such as urban development will require enhanced buffers to maintain wetland features and functions. However, within an overall watershed approach, there will still be a need to develop site specific management options to address management objectives and constraints

Buffer Function

Well designed and maintained buffers can provide a wide range of benefits such as:

- Maintaining water quality by filtering out sediment, fertilizers and other toxic materials before they enter the wetland;
- Mitigating flood impacts and protecting downstream property by reducing the impacts from storm events;
- Improving human health by removing bacteria and other disease causing organisms;
- Preventing soil erosion by stabilizing banks;
- Providing habitat including wildlife corridors, shade, food and protection for fish and wildlife, including endangered species;
- Enhancing recreational opportunities; and
- Enhancing viewscapes and aesthetics.
- It should be noted, however, that approaches which maximize specific ecological functions sometimes reduce the effectiveness of other functions, so design and implementation of riparian buffers must be undertaken with an understanding of the trade-offs that may occur.

Buffers around the wetland provide a variety of benefits.
PHOTO: SARMA LIEPENS

Linking adjacent wetlands together and to high-value upland habitats through buffers and wildlife corridors can help to offset habitat fragmentation due to land development. Large, unbroken habitat areas have been shown to be much more valuable for habitat than several smaller pieces of similar cumulative size. Connections between adjacent wetlands can significantly affect the habitat value and function of the wetland.

Current Science

There is considerable scientific information on buffer widths and an overall review is beyond the scope of this document. However, recent documents that provide a comprehensive review of the science, include:

- Wetlands in Washington State: Vol. 1. A Synthesis of the Science (Washington State, 2005) provides a recent and extensive review of the current science relating to wetland features and functions. A summary of the recommended buffer distances from the scientific review is shown in Table 1; and
- The Planner's Guide to Wetland Buffers for Local Government (Environmental Law Institute, 2008) provides a further review and synthesis of the science and found that effective buffer sizes for wildlife protection may range from 10 m to more than 1,500 m depending on the species and use.

It should be noted that in general buffers to protect wildlife habitat in wetlands generally requires larger buffers than those required to maintain water quality functions.

While the science can be highly variable around buffer distances required to maintain wetland features and functions, it does provide the scientifically credible basis on which buffer distances should be established. It is strongly recommended that land managers work with an appropriately qualified professional to ensure decisions for wetland buffer distances are based on a review of the current scientific literature.

Table 1: Summary of buffer width recommendations for wetland functions

Function	Buffer Minimum/Maximums	Comments
Sediment Control	2 – 400 m	- sediment removal increases with buffer distance - effectiveness affected by slope, particle size and adjacent land use activity
Nutrients	3.6 – 260 m	- nutrient removal increases with buffer distance - removal rates highly variable - information principally for nitrogen and phosphorous
Pathogen Control	3.8 – 35 m	- limited information; focus on faecal coliform
Influence on Microclimate	40 m	- only one study; stream buffer information not transferrable
Wildlife Habitat	15- 1,000 m	- highly variable depending on species present (e.g., amphibians, birds, small mammals) and use (e.g., breeding; foraging)
Screening (Human Activities)	14 – 61 m	- intensive land use requires larger buffers - <15m generally ineffective

Adapted from: Bried and Ervin, 2005. Wetlands in Washington State.

BUFFERS VERSUS RIPARIAN AREAS

Buffer zones are the areas above the high water mark of the wetland that may be set aside to protect or preserve wetland functions. These areas include but may extend well beyond the boundary of the wetland riparian area. Buffer widths may be set based on legal requirements or determined on a site by site basis. Generally, buffer widths should be increased as the potential level of impact from activities increases.

Riparian areas are the natural ecosystems that occupy the transitional zone between the aquatic and terrestrial ecosystems. These areas are distinctly different from the surrounding lands due to unique soil and vegetation characteristics that are strongly influenced by the presence of water for all or part of the year.

Determining Buffer Widths

While some current approaches in B.C. have adopted various forms of site assessment (e.g., Riparian Areas Regulation, *Forest and Range Practices Act*, and wetlands riparian reserves/management zones) they operate from a basic fixed width concept. Fixed buffer width approaches, while simple and easy to implement, may or may not provide the necessary level of protection for wetland features and functions.

Guidance for Protecting and Managing Wetlands (Washington State Department of Ecology, 2005) identifies four basic criteria to determine the width of a buffer:

- The functions and values of the aquatic resource to be protected by the buffer;
- The characteristics of the buffer itself and of the watershed contributing to the aquatic resource;
- The intensity of the adjacent land use (or proposed land use) and the expected impacts that result from that land use; and,
- The specific functions that the buffer is supposed to provide

WETLAND RATING SYSTEM

Washington State has instituted a wetland buffer width approach based on functions, values, sensitivity to disturbance, rarity, and replacement difficulty. The wetlands rating system includes four categories, ranging from the highest quality, rare wetland types(Category I) to the smallest, and least diverse wetlands (Category IV).

The buffer distances recommended for each alternative were developed based on the review of scientific information, as well as assumptions including wetland rating, existing and future buffer condition, horizontal buffer measurement, and the level of impact of specific activities The recommended buffer distances, based on the above information, range from 8–90 m (27–300 feet) Also, a number of conditions are outlined that may require an increase in buffer widths above those recommended (e.g., non-native buffer plant species; steep slopes and buffers used by sensitive species).

For more information see Washington State Wetland Rating System for Western Washington http://www.ecy.wa.gov/pubs/0406025.pdf and Washington State Wetland Rating System for Eastern Washington http://www.ecy.wa.gov/pubs/0406015.pdf.

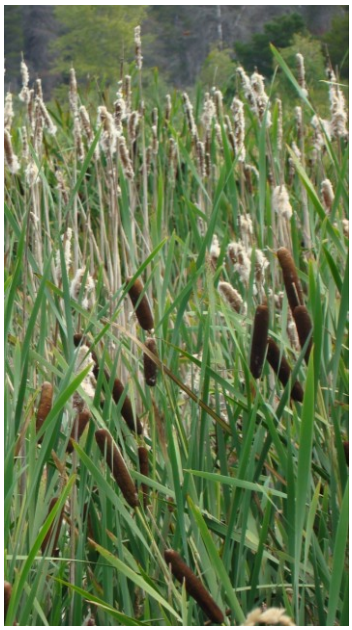
including the targeted species to be managed and an understanding of their habitat needs.

Buffer Guidelines

MAP THE BOUNDARIES OF THE WETLAND

It is important to identify the wetland boundaries so that buffers can be determined.

- ☐ Define and map the boundaries of the wetland. This can be hard to determine, especially if the wetland is seasonal in nature. An abundance of *hydrophytes* or *hydric soil* conditions may be sufficient to indicate a wetland ecosystem. The boundary of the wetland may also be identified by changes in vegetation structure, loss of hydrophytes, and absence of wetland soil characteristics. Gently sloping areas often produce large transitional zones where the vegetation boundary can be difficult to delineate. Hydrology can supplement vegetation criteria to enhance the technical accuracy, consistency, and credibility of wetland boundary delineations, and are especially useful for analyzing disturbed sites.



Bulrush – a hydrophyte (water-loving plant). PHOTO: JUDITH CULLINGTON

IDENTIFY THE BUFFER AREA

- ☐ Before establishing buffer areas, consider the whole property and its relationship to its neighbours and the local landscape.
  - ◊ What environmental problems or risks would you like to solve?
  - ◊ What kinds of buffers could help solve those problems?
  - ◊ What additional benefits might they provide?
  - ◊ What level of maintenance can you commit to?
  - ◊ What are some of the problems that may be encountered and how can they be minimized, for example, nuisance wildlife and wildlife related damages?
- ☐ Work with an appropriately qualified professional to identify buffers because conditions vary on a site-by-site basis. The appropriate buffer width will depend on its purpose and the sensitivity of the habitat that is to be protected.
- ☐ Create buffers that are wide enough to protect the *ecological integrity* of the wetland—both the habitats and the plants and animals these ecosystems support. Buffer distances are measured from the outside extent of the riparian area of the wetland. Riparian buffer widths will vary according to the type, size, location of the wetland, the land use and the established objectives.

- ☐ When establishing riparian buffers, consider the needs of all species and not just fish. For example, riparian buffer widths determined using the Riparian Areas Regulation methodology focus on the needs of salmon and trout and may not be wide enough to protect other species such as amphibians, birds, and small mammals. An appropriately qualified professional can provide site-specific advice.
- ☐ Consider incorporating or increasing buffers around stream riparian areas that feed directly into identified sensitive wetlands. These will help in minimizing impacts to the wetland from upstream impacts
- ☐ In populated areas, fence the buffer area to discourage access by people and pets.
- ☐ Retain or restore native vegetation in the buffer area, including trees, shrubs, and ground cover.

Protect Downstream Wetlands

- ☐ Increase stream buffers along streams that drain directly into sensitive wetlands. Wetland buffers provide some protection from adjacent land use disturbance but may not fully protect wetlands from disturbance within the watershed. Enhanced upland stream buffers can provide additional protection.

Protect downstream wetlands. Columbia River Valley.
PHOTO: SARMA LIEPENS

2.4.3. Protecting Habitats and Species

Many species require or prefer habitat which is as close as possible to water and/or has moist conditions, characteristics generally present in wetlands. Wetlands provide critical habitat for many species of amphibians, birds and fish, including food, shelter, migratory and overwintering areas, and breeding areas. The 'edge' where floodplain habitat borders vegetated wetlands or water bodies is frequently very high in wildlife richness and diversity.

Aquatic Habitats

Wetlands are an important form of aquatic habitat providing food, breeding habitat, and cover for many species.

PROTECT AQUATIC HABITATS AND VEGETATION

- ☐ Maintain the quantity and quality of water entering and leaving the wetland. See SECTION 2.4.4: PROTECTING WATER QUANTITY and SECTION 2.4.5: PROTECTING WATER QUALITY for details.
- ☐ Recognize the importance of small wetlands and streams. Avoid draining wetlands, regardless of their size, depth or duration.
- ☐ Protect emergent and submerged vegetation. The maintenance of hydrological regimes and water quality is dependent in part on vegetation for intercepting precipitation, evapotranspiration and filtration.
- ☐ Follow the measures outlined in the *Standards and Best Practices for Instream Works* where work is being undertaken in or near aquatic ecosystems.

Retain specialized habitats such as coarse woody debris.
PHOTO: JUDITH CULLINGTON

RETAIN SPECIALIZED HABITATS

- ☐ Identify and provide protection for specialized habitats, such as
  - ◊ areas of concentrated wildlife use,
  - ◊ fish spawning and/or rearing areas,
  - ◊ overwintering areas,
  - ◊ breeding areas, including turtle nesting sites,
  - ◊ coarse woody debris,
  - ◊ habitats for species at risk,
  - ◊ travel corridors for large and small wildlife, and
  - ◊ vernal pools.

VERNAL POOLS

Vernal pools (ephemeral or seasonal wetlands) provide habitat that is highly suitable for amphibian reproduction. In general, these areas have standing water from late fall to spring and dry up completely by mid-summer. This condition allows amphibians to successfully reproduce without fish predation. Those wetlands with the capacity to hold water at a depth of at least 60 cm will generally provide the best habitat for these organisms.

Do not turn these seasonal pools into year-round features.

Retain vernal pools.
PHOTO: JUDITH CULLINGTON

Riparian Habitats

Riparian ecosystems form where the areas surrounding wetlands are subject to occasional flooding. These ecosystems support vegetation that may not tolerate the more intensive waterlogging in the aquatic part of the wetland, but that tolerates periodic inundation. The riparian ecosystem influences, and is influenced by, the wetland.

PROTECT RIPARIAN AREAS

- ☐ Check with Fisheries and Oceans Canada, Ministry of Environment and local government personnel before working in riparian areas. Removal or alteration of riparian vegetation may constitute an offence under the *Fisheries Act*, Riparian Areas Regulation, other federal or provincial legislation, or local government bylaws.
- ☐ Ensure riparian ecosystems are included within the buffer surrounding the wetland. See SECTION 2.4.2: BUFFERS for more information.
- ☐ Maintain riparian vegetation cover. The roots of trees and shrubby vegetation such as willows, red-osier dogwood, and hardhack help stabilize banks and prevent bank erosion.
- ☐ Maintain the vegetation and structure of the shoreline so that it can continue to provide breeding habitat, escape cover, and food for fisheries and other wildlife.
- ☐ Allow natural flooding cycles to occur so that flood-dependent ecosystems can persist. Many species depend on the ecosystems that develop in response to natural flooding.
- ☐ Undertake activities in the riparian buffer only when ground conditions are suitable (i.e., either dry or frozen) to avoid compacting soils and damaging vegetation.

B.C. Ministry of Environment offices: see http://www.env.gov.bc.ca/main/regions.html

Fisheries and Oceans Canada offices: see http://www.pac.dfo-mpo.gc.ca/pages/default_e.htm

- ☐ If an enhanced viewscape is to be created, selectively thin tree branches and understorey but maintain 80 to 90% of the existing canopy.
- STOP Do not mow or remove understorey bush, except as advised by an appropriately qualified professional to enhance habitat for local native species.
- STOP Do not place slash, branches, and limbs resulting from cutting and removal operations within the riparian area or in a location where they are likely to enter the wetland, unless an appropriately qualified professional suggests doing so to add coarse woody debris where it is lacking. Removing slash results in greater compaction.

LIMIT RECREATIONAL ACCESS TO WETLANDS

- ☐ Maintain the natural shoreline and design access to the wetland to avoid shoreline damage and disturbance to wildlife. For more information on recreational access, see CHAPTER 8: RECREATIONAL ACTIVITIES.

Limit access to shorelines. PHOTO: SARMA LIEPENS

Upland Habitats

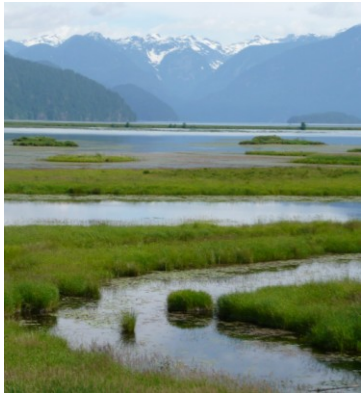
Upland areas adjacent to wetland riparian areas (e.g., grasslands, forested lands) are often critical habitat for wetland species, which use these areas for feeding and breeding.

In addition, activities on the uplands may impact the wetland itself. These impacts will vary with the type of activity (e.g., roads, urban development and forest harvesting), proximity to the wetland, adjacent slope and soil type, and the width and integrity of the wetland buffer.

- ☐ Protect upland habitats that are integral to wetland function. For example, this could include maintaining wildlife travel corridors for amphibians that need to migrate to and from the wetland.

Estuarine Habitats

Estuaries are the mixing zones between the marine and freshwater environments. Mixing of fresh and salt water is primarily affected by tidal movements. Most species that inhabit estuarine areas are marine in origin although there are important exceptions (e.g., migrating juvenile salmon). Estuaries are highly productive areas ecologically due to the constant supply of nutrients delivered from the upstream watershed. However, this productive capacity can be severely impacted by toxins, pollutants and excess sediments carried downstream or discharged directly into estuaries. Many estuarine areas have been lost due to infilling for urban, industrial, and port development.



Estuaries are ecologically productive.
PHOTO: CLAIRE DE LA SALLE

- ☐ Check with Fisheries and Oceans Canada and local government personnel before clearing vegetation from waterfront areas. Removal or alteration of riparian vegetation along lakeshores may constitute an offence under the *Fisheries Act* or local planning bylaws.
- ☐ Maintain natural vegetation along shorelines to minimise erosion and retain wildlife habitat. Pathways providing access to wharves and docks should be narrow. Maintaining natural shoreline vegetation protects water quality and important nesting and feeding sites for wildlife.
- ☐ Locate foreshore accesses and structures so as to avoid environmentally valuable resources and areas with poor slope stability. Keep the number of access points to a minimum.

Consider soft options to address shoreline erosion.
PHOTO: ROBERT COX

STOP Avoid constructing retaining walls—these restrict wildlife access to the waterfront and, unless properly engineered, may fail. For information on soil bio-engineering and streambank restoration, see the Society for Ecological Restoration website.

☐ Consider 'soft' options such as soil bio-engineering solutions to address shoreline erosion. These are often less costly and more environment-friendly than traditional 'hard' engineering treatments.

☐ Protect lakeshores (which often include shallow water wetlands). Refer to the *Best Management Practices for Lakeshore Stabilization* for information on lakeshore stabilization techniques. Some shoreline stabilization techniques can be detrimental to fish, amphibians, and other wildlife, and should be used only where there is evidence of active erosion. The *Marine Guide to Small Boat Moorage* and *Best Management Practices for Small Boat Moorage on Lakes* also provide useful information on protecting lakeshores. Consult the Living by Water organization and B.C. Lake Stewardship Society for advice on ways to protect and enhance shorelines.

☐ Protect coastal shorelines (including estuaries). For information on protecting coastal shorelines, see:

- ◊ Green Shores website;
- ◊ *Coastal Shore Stewardship: A Guide for Planners, Builders and Developers*;
- ◊ *Shoreline Structures Environmental Design: A Guide for Structures along Estuaries and Large Rivers*;
- ◊ *Caring for Our Shores: A Handbook for Coastal Landowners in the Strait of Georgia*; and
- ◊ *Sustainable Approaches to Coastal Design*.

The **Green Shores** project promotes sustainable use of coastal ecosystems through planning and design that recognizes the ecological function of coastal systems.

http://www.greenshores.ca/

Species

Many reptiles and amphibians use wetlands as habitat. Garter snake eating tree frog.
PHOTO: SARMA LIEPENS

Wetlands and their surrounding uplands are home to approximately 500 species of plants, animals and insects in British Columbia.[3] This includes mammals, birds, amphibians and reptiles, fish, and many invertebrates which use wetlands as habitat, for food, water, breeding and nesting grounds, resting areas, and shelter.

RETAIN AND CREATE WILDLIFE TRAVEL CORRIDORS

A wetland/riparian area may serve as a significant travel corridor for wildlife movement from one area of natural vegetation to another area of natural vegetation.

- ☐ Ensure that migratory areas along the riparian corridor, and the movement of wildlife, are unimpeded by barriers within the riparian area. Check with an appropriately qualified professional.

SCHEDULE CONSTRUCTION ACTIVITIES TO AVOID SENSITIVE TIME PERIODS

Some species are more tolerant of disruption during certain seasons. 'Timing windows' or 'least risk windows' allow construction to proceed at times when its impacts on local plants and wildlife will be minimized.

Timing windows have been developed for many ecosystems and species in B.C., including fish and aquatic habitats, and for sensitive nesting periods for birds, mating and denning times for animals, and flowering and seed set periods for many plant communities. Harassment or disruption of wildlife is prohibited at any time under the B.C. *Wildlife Act* and operators are advised to be mindful of potential impacts regardless of the timing of operations.

- ☐ Schedule disruptive construction activities (e.g., clearing, blasting) so that sensitive periods such as nesting, spawning, hibernating, migration, and larval rearing are avoided.
- STOP Avoid construction activities during periods when amphibians and reptiles are congregated for breeding, nesting, or seasonal migrations. Migrations could involve movements of snakes near hibernacula and mating areas in the spring and autumn, migrations of juvenile frogs, toads, and salamanders to foraging habitats in late summer, or movements of turtles to terrestrial nesting sites.

[3] B.C. Species and Ecosystems Explorer

- Avoid land clearing or development activities between April 1 and July 31 (the active nesting period of most bird species) to avoid disturbing nesting birds and damaging their nesting habitats, in compliance with the *Wildlife Act* (Section 34). The Migratory Birds Regulation under the *Migratory Birds Convention Act* prohibits the destruction of migratory birds, their eggs and their nests which includes many wetland dependent species. Environment Canada is currently drafting new regulations under the Act.

  Check to see which species are present in your area. Some bird species have multiple broods and may nest outside of this time period. For herons and raptors, follow the guidelines in the *Develop with Care* fact sheets.

- ☐ Follow prescribed timing windows for construction in and around wetlands. Review the Ministry of Environment *Least Risk Work Windows for Instream Works in British Columbia*[4] and check the regional Ministry of Environment website for specific timing windows for your region. In some years, weather conditions (such as dry or early spring weather) may allow some works to begin sooner or end later than the normal timing window dictates. This can be a significant advantage for projects with tight schedules. Maintain frequent contact with appropriately qualified professionals to ensure that you are aware of any modifications to timing window dates.

Follow prescribed timing windows.
Killdeer eggs.
PHOTO: SARMA LIEPENS

BEST PRACTICES FOR AMPHIBIANS AND REPTILES

Amphibians and reptiles are intimately linked to wetlands, however habitat destruction, alteration and fragmentation have contributed to a rapid decline in populations in the last two decades. Amphibians use wetlands, including small ephemeral wetlands for rehydrating, breeding, cover and foraging. Most species stay within 500 m of their breeding sites, but amphibians may use land as much as two–three km away.

See *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia* for detailed information on wetland management for amphibians and reptiles.

Species at Risk

The rich and diverse habitats associated with wetlands and adjacent habitats make these areas home to a significant number of species at risk in British Columbia. Loss of wetland and associated habitat is a major contributor to the number of threatened and endangered species in B.C.

In more populated areas activities such as urban development, forest harvesting, agriculture, use of off highway vehicles, and invasions of exotic species have eliminated or are threatening many native wetland species and ecosystems. British Columbia does not yet have specific species at risk legislation such as exists in *Ontario Endangered Species Act*. Species at risk are managed, directly or indirectly under a variety of provincial legislation including the *Forest and Range Practices Act, Parks Act, Ecological Reserves Act, Water Act,* and Riparian Areas Regulation among others. On federal lands, the *Species at Risk Act* also applies.

The Species at Risk and Local Government website (http://speciesatrisk.bc.ca/) provides a way to find out about species at risk in each regional district.

IDENTIFY SPECIES AT RISK

- ☐ Check for species at risk in your area. The B.C. Ministry of Environment provides searchable information on known locations of species and ecological communities at risk, and the Species at Risk and Local Government website lists species at risk found in each regional district.
- ☐ Hire an appropriately qualified professional(s) to assess whether a proposed project or activity will have an adverse effect on species at risk. For information on assessments see **SECTION 2.4.1: WETLAND MAPPING, INVENTORY AND ASSESSMENT**.

  Wetlands, particularly in areas where their numbers and area have been significantly reduced (e.g., east coast Vancouver Island, Lower Mainland and Southern Interior), should be specifically assessed for the presence of species at risk.

- STOP Avoid projects or activities that would have any adverse effect on wildlife habitat sites of rare vertebrates, invertebrates or plants as

B.C.'S CONSERVATION FRAMEWORK

British Columbia has recently released a Conservation Framework. This Framework was developed by the Ministry of Environment and provides a set of science-based tools and actions to prioritize species and ecosystems for conservation actions. The goals of the Framework are to contribute to global species and ecosystems conservation; prevent species and ecosystems from becoming extinct; and maintain native species and ecosystems diversity.

See also Biodiversity BC's 2008 report *Taking Nature's Pulse: The Status of Biodiversity in British Columbia*.

identified under the federal *Species at Risk Act* or provincial listing under the *Wildlife Act* or *Forest and Range Practices Act*.

For detailed information on species and ecological communities at risk in British Columbia visit the Conservation Data Centre website.

The Invasive Plant Council of BC (IPCBC) has prepared a series of T.I.P.S or Targeted Invasive Plant Solutions. Each T.I.P.S publication focuses on the best management practices, and Integrated Pest Management (IPM) principles for a specific operational activity. See http://www.invasiveplantcouncilbc.ca/

Invasive Species

Invasive or 'alien' species are plants and animals that have been transported accidentally or deliberately into a new environment. Some invasives find conditions suitable for survival, growth and reproduction and their populations can explode, significantly impacting native species and habitat. As well as the ecological impacts, alien species can also have major economic and human health risks.

Wetlands can lose between 50–100% of their native vegetation due to purple loosestrife invasion, which in turn leads to the displacement of many animals, such as muskrats and birds.[5]

Management of identified agricultural and forest pests in Canada costs the economy $7.5 billion dollars annually while in the U.S. these costs exceed $135 billion/year. Overall ecological costs on native ecosystems are unknown.

PREVENT THE INTRODUCTION OF INVASIVE SPECIES

- ☐ Clean boats motors and other equipment before moving to a new location. Ensure that packs, shoes and other equipment are free of seeds or other plant material before moving to a new location.
- ☐ Ask operators to wash heavy equipment before bringing it into a wetland area for restoration/construction/maintenance as a prevention measure against the spread of invasive weeds.
- ☐ Remove invasive species before they can become established.
- STOP Never introduce invasive non-native species (plant or animal) into wetland areas. Fish species cannot be moved or transplanted in the Province without a permit.

MANAGE INVASIVE SPECIES

- ☐ Maintain healthy riparian vegetated borders to discourage the spread of invasive species.
- ☐ Where practical, control or eradicate invasive species through manual means such as pulling or trapping. This is generally only practical on a local scale.
- ☐ During construction, stabilize disturbed areas with mulch or grasses and re-vegetate disturbed areas with native plants.

[5] Fraser Basin Council, 2003.

Purple loosestrife—an invasive wetland plant.
PHOTO: WIKIPEDIA WEBSITE

BEAUTIFUL KILLER

Purple loosestrife is an invasive wetland species throughout much of British Columbia. It can form dense stands that reduce plant and animal diversity in wetland ecosystems. A single flowering stalk can produce 300,000 seeds, and densities exceeding 32,000 stems/ha have been recorded. New infestations can be prevented by minimizing disturbance and seed dispersal. Handpulling isolated plants can be effective on small infestations—pulling should be conducted before plants set seed. Remove the entire root of the plant to avoid regrowth from root fragments.

Further information on invasives can be found at the Ministry of Environment alien species website.

2.4.4. Protecting Water Quantity

Surface Water

Changing how water enters or leaves a wetland can alter wetland function. For example, the ability of a wetland to hold flood water can be reduced if run-off is diverted from the wetland. Likewise, adding water to a wetland can make it hold water year around, helping non-native species like the American bullfrog and harming native species like the red-legged frog. Impermeable surfaces and roads can intercept and redirect natural drainage patterns, increasing or decreasing the amount and timing of water inputs to wetlands.

During dry periods the water retained in wetlands is essential to the maintenance of base flow levels in many rivers and streams, which in turn is important to the maintenance of water quality and water supplies.

MAINTAIN WATER INFLOW

- STOP Avoid channelizing wetland inlets as this can increase the velocity and turbidity of incoming water, leading to erosion and scouring of the channel banks and bed.
- STOP Do not divert water into a wetland from another source unless this is part of an approved restoration or enhancement plan. Additional water may increase flood levels and scouring and may contain toxins and pollutants which will negatively affect water quality and aquatic life. Additional water may join isolated wetlands making them ecologically more 'lake-like' and less productive, or it might provide fish access to previously fish-free areas (harming amphibian and insect life).

MAINTAIN WATER OUTFLOW

☐ Maintain the natural drainage channel at wetland outlets:

- ◊ Constricting the outlet will cause water to back up and flood beyond natural levels;
- ◊ Deepening or straightening of the outlet will create a head-cut, resulting in the dewatering of the wetland, and increasing flooding downstream; and
- ◊ Accelerated dewatering of the wetland may lead to higher water temperatures during summer and may cause the wetland to freeze to the bottom in the winter, impairing normal ecological functioning.

Enable natural flood regimes to continue.
PHOTO: DOUG BIFFARD

MAINTAIN NATURAL FLOOD REGIMES

☐ Enable natural flood/dry cycles to continue. Land adjacent to wetlands provides a temporary storage area for flood water which has overtopped the bank. During periods of peak run-off, flood waters are slowly released through evaporation, percolation, and surface discharge. The percolation is important for groundwater recharge.

☐ Where activities may reduce water storage, ensure there is sufficient additional flood storage added within the 100 year flood elevation. Historical flood levels may be determined from archival photos or descriptions. Flood plain mapping is available from the Ministry of Environment's B.C. Water Resources Atlas. Increased storage volume should be in the same watershed and have unrestricted access to the stream and wetland. If unsure of flood elevations seek the assistance of an appropriately qualified professional.

MAINTAIN WATER FLOWS

Hydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands should be protected to prevent adverse impacts on:

- Water currents, erosion or sedimentation patterns;
- Natural water temperature variations;
- The chemical, nutrient and dissolved oxygen regime of the wetland;
- The movement of aquatic fauna;
- The pH value of the wetland; and
- Water levels (elevations).

MAINTAIN THE NATURAL TOPOGRAPHY

- Avoid filling the wetland, as this can increase the extent and level of flooding and may displace flooding onto adjacent properties, resulting in property damage. Infilling can cause water to spread out over a larger area at a lower depth, which may result in increased water temperature and a decrease in habitat in the main channel, both of which are detrimental to fisheries, particularly during periods of warm weather and low flows.

- Avoid excavation of the wetland, as this can result in a breach of impermeable soil layers and cause water to drain away into gravels or permeable soils layers below.

Encourage use of pervious surfaces.
PHOTO: JUDITH CULLINGTON

Groundwater

Wetland areas often contribute to groundwater recharge. Groundwater near the surface may be directly linked to wetlands and streams and can provide important base flows to watercourses during dry periods. Groundwater can also infiltrate into wetlands and be a stabilizing factor ensuring high water conditions in drier areas and seasons. Unlike surface flow, there is often very little information on groundwater levels, quality and use. Groundwater resources should be managed conservatively.

LIMIT IMPERVIOUS SURFACES AND GROUND COMPACTION

- ☐ Minimize the amount of paved and cement surfaces, which can prevent rainwater from reaching underground water tables.

- Do not allow the ground within or around a wetland to become compacted. This can affect the hydrology of a wetland to the degree that it may be entirely cut off from its groundwater source. Clay soils are especially vulnerable to compaction.

ENCOURAGE GROUNDWATER RECHARGE

- ☐ When developing land near wetlands, use a variety of techniques to encourage groundwater recharge, such as infiltration ponds, permeable paving, and green roofs. Develop rain-gardens that treat run-off before it reaches the wetland. For details, see *Stormwater Planning: A Guidebook for British Columbia*.

As little as 10-15% impervious surface area in a watershed can affect hydrologic functioning, and impact fish and other aquatic populations.

Mosquito breeding areas close to home are of greater concern re the spread of West Nile Virus. IMAGE FROM DUCKS UNLIMITED FACT SHEET HTTP://WWW.DUCKS.CA/CONSERVE/ISSUES/PDF/FACT2008.PDF

MAINTAIN WATER FLOWS

West Nile Virus has become a health concern in some parts of Canada, although to date it has not been recorded in British Columbia. As some species of mosquito transmit the virus, concerns are sometimes expressed about wetlands, which are often mosquito breeding habitats. However, wetlands also support hundreds of other wildlife species including frogs, salamanders, fish, birds, bats, dragonflies and other animals that eat mosquitoes. Sources of standing water close to homes (such as old tires) are often a greater source of concern.

http://www.ducks.ca/conserve/issues/pdf/fact2008.pdf

2.4.5. Protecting Water Quality

Properly functioning wetlands have a key role in maintaining and enhancing water quality by trapping and filtering sediment and pollutants. This in turn maintains the quality of downstream habitats. Organic soils and sediments under wetlands help to detain and remove dissolved and particulate nutrients (such as nitrogen and phosphorous) from the surface water above and also serve as traps for toxic substances (such as heavy metal compounds). Contaminants introduced into these areas, such as septic system discharges and road salts can contaminate groundwater and neighbouring wells.

Water quality guidelines, standards and objectives for the protection of aquatic life have been developed by:

Environment Canada: Canadian Environmental Quality Guidelines (not available online);

Ministry of Environment Water Quality Guidelines;

Alberta Surface Water Quality Guidelines

Changes to the quality of incoming water may include alterations to: turbidity, colour, odour, sediment load, turbidity, pH, toxins, pathogenic organisms, metals and nutrient loading. Water quality objectives and standards may be different for different classes of wetlands (e.g., peatlands vs. marshes) and for different geographic areas.

Erosion and Sediment Control

Where activities result in exposure of mineral soils and subsoils, control of erosion and sediment is essential to prevent overloading the filtering capacity of wetland riparian areas and the infilling of wetlands. Sedimentation of wetlands could lead to charges under the *Fisheries Act* if it causes harmful alteration, disruption or destruction (a HADD) of fish habitat.

Table 2: Provincial Water Quality Guidelines for Induced Turbidity and Suspended Sediment[6]

Water Use	Maximum induced turbidity - NTU or % of background level	Maximum induced suspended sediments - mg/L or % of background level
In clear water or during clear flow periods: Aquatic life - fresh - marine - estuarine	8 NTU in 24 hours when background is less than or equal to 8 OR: Mean of 2 NTU in 30 days when background is less than or equal to 8	25 mg/L in 24 hours when background is less than or equal to 25 OR: Mean of 5 mg/L in 30 days when background is less than or equal to 25
For high flows or turbid flow periods: Aquatic life - fresh - marine - estuarine	5 NTU when background is between 8 and 50 OR: 10% when background is greater than 50	25 mg/L when background is between 25 and 250 OR: 10% when background is greater than or equal to 250

NTU: Nephelemetric Turbidity Unit – a standardized measure of turbidity using light diffraction. Larger increases for induced turbidity during clear flow periods vs turbid flows reflect the restricted 24 hour period and the general reversibility of potential impacts.

Avoiding erosion will also maintain soil productivity in the areas adjacent to the wetlands. See specific chapters (e.g., CHAPTER 3: WETLAND GUIDELINES FOR AGRICULTURE) for more specific details regarding erosion and sediment control guidelines for these activities.

The B.C. water quality guidelines for induced turbidity and suspended sediment for the protection of aquatic life are summarized in Table 2.

PLAN TO AVOID EROSION AND SEDIMENTATION

☐ Develop a plan for erosion and sediment control with the assistance of an appropriately qualified professional before activities begin. The plan should include:

- ◊ Methods to minimize the extent of the area cleared at any one time;
- ◊ Options for source control and removal of contaminants from runoff;
- ◊ Detailed directions to any contractors or machine operators to ensure that no erosion or sediment movement occurs and no silt is released into adjacent wetlands; and
- ◊ Directions for prompt planting of appropriate native species.

[6] From http://www.env.gov.bc.ca/wat/wq/BCguidelines/turbidity/turbidity.html

The Greater Vancouver Regional District Guidelines for Stormwater Management includes best practices for erosion and sediment control on site. For more information, see Appendix H http://www.gvrd.bc.ca/sewerage/management_guide.htm

- ☐ Consult the *Land Development Guidelines for the Protection of Aquatic Habitat* for more information.

MINIMIZE EROSION AND SEDIMENTATION DURING CONSTRUCTION ACTIVITIES

Failure to prevent the movement of sediment and other deleterious substances into riparian areas and/or aquatic ecosystems could result in legal charges or an Inspector's Order under the *Fisheries Act* and the *Environmental Management Act*. For more information, see the Water Quality Municipal Guidelines for Construction Design website.

- ☐ Hire an appropriately qualified professional to:
  - ◊ Provide monitoring to ensure that the plan is properly implemented;
  - ◊ Ensure that construction does not impact wetlands and adjacent riparian areas; and
  - ◊ Provide long-term monitoring of replanted sites until vegetation is established and self supporting and disturbed soils are stable.

A Soil Conservation Survey Accreditation course is available from Vancouver Island University in Nanaimo. For more information see http://www.mala.ca/nrep/forestry/soildisturbance.asp.

- ☐ Construct runoff management systems at the beginning of site disturbance and inspect these regularly to ensure continuing operation.
- ☐ Clear areas only as needed and minimize total disturbed area especially on steep sites. Exposed soils should be stabilized as soon as possible.
- STOP Avoid vegetation clearing during periods of inclement weather such as heavy rainfall or snowmelt, as this would leave bare soils vulnerable to erosion.
- ☐ Consider additional stormwater runoff requirements for projects that will be constructed during the rainy season.
- ☐ Manage surface flows to control sheet, rill and gully erosion. Roughen and/or terrace steep slopes to prevent erosion.
- STOP Avoid the collection, concentration and conveyance of surface water. Instead encourage surface water to percolate into the soil.
- ☐ Use erosion and sediment control techniques to prevent silt-laden waters from entering into wetlands, and other aquatic ecosystems.
- ☐ Wash fresh concrete and concrete equipment well away from wetlands and their riparian areas, and keep the contaminated runoff out of stormwater systems that connect to these areas.

Use temporary coverings for soil stockpiles.
PHOTO: JUDITH CULLINGTON

- ☐ Use temporary coverings (tarps) for soil stockpiles and cover bare soils with mulch (leaves, wood chips, straw, etc.) to control raindrop erosion.
- STOP Do not allow fill or construction material to encroach into riparian areas.

Dissolved Oxygen

Dissolved oxygen (DO) refers to the amount of oxygen freely available in the water for uptake by aquatic organisms. It must be available in sufficient quantities for their survival (which vary by the type of aquatic organism, location and season). The levels of dissolved oxygen are affected by factors such as temperature (colder water can hold more dissolved oxygen than warmer water); water flow (moving turbulent water will hold more oxygen) and photosynthesis (plants release oxygen during daylight and take it up during the night). Oxygen levels will also vary due to uptake by organisms and through chemical oxidation.

MEASURE AND MONITOR DISSOLVED OXYGEN LEVELS

- ☐ Measure natural dissolved oxygen (DO) levels prior to any activities that may impact wetland DO levels (e.g., increased nutrient levels) . Dissolved oxygen concentration objectives for aquatic life in B.C. are set by the Ministry of Environment Water Quality Guidelines at
  - ◊ 5 mg/L O_2 instantaneous, and
  - ◊ 8 mg/L O_2 30 day average.

  Sampling for dissolved oxygen is based on a number of factors including known oxygen variability levels, most sensitive species present (e.g., life stages and duration), and logistical constraints (e.g., cost, distance).
- ☐ Maintain natural and seasonal variations of dissolved oxygen by retaining (or re-establishing) the natural hydrological cycle.
- ☐ Monitor dissolved oxygen following construction. For normal ambient monitoring, five measurements taken weekly within 30 days is a minimum frequency. Additional sampling will likely be necessary depending on the objectives of the monitoring program.

Acidity (pH)

pH is a measure of the dissolved H+ activity in water. The more free ions present the lower the pH, with levels less than 7 referred to as acidic while a pH greater than 7 is described as being alkaline. A pH of 7 is

considered neutral. Most aquatic organisms have optimal survival levels bordering neutral pH (6.5–8.0), closely reflecting the levels in natural healthy water systems. Some wetlands such as peats and bogs have naturally occurring lower pH levels (4.5–5.5). Organisms such as amphibians are more susceptible to decreases in pH over natural fluctuations, especially during larval development.

MEASURE AND MONITOR pH LEVELS

- ☐ Measure natural pH levels prior to developments near a wetland.
- ☐ Maintain wetland pH levels within 0.5 units of the natural background range.
- STOP Do not place fill, soil, chemicals or other materials into the wetland or near the wetland that might alter the natural pH range.

Toxins and Pollutants

Substances which are toxic or harmful to human, animal or plant life may cause adverse impacts on wetland species, if they are present in certain concentrations or combinations. Floating or submerged debris, oil, deleterious substances, or other material should not be present in amounts which could cause adverse impacts on wetlands.

PREVENT CONTAMINATION

- ☐ Use all fertilizers, pesticides, herbicides and similar chemicals only as absolutely necessary, and apply strictly in accordance with the manufacturer's instructions and applicable municipal, provincial, and federal laws and regulations governing their use.
- ☐ Reduce or eliminate the use of fertilizers on nearby lawns and gardens. Do not over-water after application or apply prior to significant rainstorms, to prevent surface runoff from carrying chemicals to adjacent waterways.
- STOP Avoid the use of any oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or toxic to aquatic life.

PREVENT SPILLS AND CONTAMINATION

- ☐ Keep all fuel and lubricants outside the wetland area and contained so that any spills cannot enter the natural environment. For more information see the Field Guide to Fuel Handling, Transportation and Storage.

- ☐ During construction, keep all fuelling stations and mobile fuelling equipment at least 30 m from wetlands. Use secondary containment around fuelling areas to prevent contamination from spills and leaks.

Nutrients

While other trace elements are necessary for plant growth, the two primary limiting nutrients are nitrogen and phosphorus. These nutrients can come from natural sources (e.g., rock weathering, soils) or from human sources such as fertilizers, manure, and improperly treated wastewater. Excessive amounts of nutrients can cause a rapid increase in plant growth, particularly near the surface. As deeper-water plants become shaded and surface plants die off, bacteria begin to decompose plant material, using up available oxygen in the process. If the biological oxygen demand (BOD) of the bacteria becomes too high other aquatic fauna and flora may 'suffocate' from lack of oxygen.

Thick mats of algae can result from nutrient overload (e.g., introduction of cattle faeces) which this affects temperature. In the interior of B.C., thick algal mats keep water temperatures cooler which may affect some species—for example amphibians develop faster in warm water. Also amphibians and other organisms can get trapped in the algae or beneath it. Those which need to get to the water's surface for air may be trapped below and suffocate, and tadpoles transitioning to adult forms may not be able to emerge

For more specific information on agricultural nutrient guidelines see CHAPTER 3: WETLAND GUIDELINES FOR AGRICULTURE.

Algal mat. PHOTO: SARMA LIEPENS

Hardhack.
PHOTO: ROBERT COX

MAINTAIN RIPARIAN BUFFERS

- ☐ Ensure that riparian buffers are protected and maintained to allow for nutrient retention and uptake.
- ☐ In areas with high nutrient loading or steeper topography riparian buffers widths may need to be increased or functionality improved through enhancement (e.g. increased density/variety of riparian vegetation). For more information see SECTION 2.4.2: BUFFERS.

MANAGE DISCHARGES

- ☐ Locate septic system infiltration fields at least 30 m horizontally from wetland annual high water mark. A greater distance may be required by local bylaws or regulation.
- ☐ Ensure that septic systems at homes and cottages are maintained and properly functioning. See CHAPTER 8: RECREATIONAL ACTIVITIES for information on recreational properties.
- ☐ Use only biodegradable soaps and detergents where wastewater might end up in or near wetlands. Don't use antimicrobial soaps as these may affect the natural microbial balance in the wetland.
- STOP Do not put toxic materials into septic systems, sewers or down storm drains.

Temperature

Water passing through a wetland can remove over 90% of phosphorous and nitrogen draining from the surrounding watershed. (Ducks Unlimited, 2008)

Most aquatic organisms have adapted over time to a specific range of water temperatures with early life stages generally being more sensitive to temperature changes. Water temperature affects the solubility of oxygen, the metabolic rates of aquatic organisms, and photosynthetic rates of algae and higher plants. Stress related to significant temperature increases can also increase sensitivity of organisms to toxins, parasites, and other diseases. Temperature increases can occur where water flows to a wetland have been reduced affecting water exchange rates and depth and from warm water point discharges. Long-term changes in temperature can affect the biodiversity of the wetland.

Water temperature guidelines for temperature set by the Ministry of Environment for aquatic life are summarized in Table 3.

Table 3: Provincial Water Temperature Guidelines[7]

Water Use	Recommended Guideline
Freshwater Aquatic Life - streams with known fish distribution	+ or - 1 degree Celsius change beyond optimum temperature range as shown in *Table 2: Optimum Temperature Ranges of Specific Life History Stages of Salmonids and Other Coldwater Species for Guideline Application* for each life history phase of the most sensitive salmonid species present. Hourly rate of change not to exceed 1 degree Celsius
Freshwater Aquatic Life - streams with unknown fish distribution	Mean Weekly Maximum Temperature (MWMT) = 18 degrees Celsius (Maximum Daily Temperature = 19 degrees Celsius) Hourly rate of change not to exceed 1 degree Celsius Maximum Incubation Temperature = 12 degrees Celsius (in the spring and fall)
Freshwater Aquatic Life - lakes and impoundments	+ or - 1 degree Celsius change from natural ambient background
Marine and Estuarine Aquatic Life	+ or - 1 degree Celsius change from natural ambient background the hourly rate of change up to 0.5 degrees Celsius

MAINTAIN NATURAL TEMPERATURE LEVELS AND VARIATION

- ☐ Maintain seasonal and daily temperature variations (including amplitude and frequency). This includes maintaining such things as shade, warm water inputs, and water levels. At the same time, ensure that your activities do not cause temperature fluctuations that would be harmful to aquatic species, including conditions necessary.

For recommended temperature guidelines for drinking water, wildlife and livestock watering, irrigation, and recreation and aesthetics see the B.C. Water Quality Guidelines for Temperature.

Faecal Coliforms

Contaminated water has always been an important agent in the spread of disease organisms. Since the direct monitoring of all possible pathogens would be too slow and costly for routine water quality control, microbiological water quality is usually monitored and reported based on a single or select suite of indicator organisms. Current provincial criteria are based on bacteria present in human and animal faeces, as distinct from other bacteria which may be found in sewage. Faecal bacteria from animals present less risk of human disease than human faecal bacteria.

With the exception of shellfish, B.C. does not have any recommended guidelines for microbiological indicators for aquatic life. Also, there are

[7] From http://www.env.gov.bc.ca/wat/wq/BCguidelines/temptech/temperature.html#tab2

currently no routine monitoring procedures for viruses and hence no criteria.

FOLLOW PROVINCIAL GUIDELINES

- ☐ Follow the B.C. Water Quality Guidelines for microbiological criteria for drinking water, recreation, livestock, and irrigation.

2.4.6. References

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B.C. Conservation Framework. http://www.env.gov.bc.ca/conservationframework/

B.C. Lake Stewardship Society. http://www.bclss.org/

B.C. Ministry of Environment Guidelines and Best Management Practices. http://www.env.gov.bc.ca/wld/BMP/bmpintro.html

B.C. Species and Ecosystems Explorer. http://www.env.gov.bc.ca/atrisk/toolintro.html

B.C. Water Resources Atlas. http://www.env.gov.bc.ca/wsd/data_searches/wrbc/index.html

Biodiversity B.C. http://www.biodiversitybc.org/EN/index.html

Community Mapping Network and Sensitive Habitat Inventory and Mapping Atlas. http://cmnbc.ca/

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Species at Risk Public Registry. http://www.sararegistry.gc.ca

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APPENDIX 2.1: LEGAL PROTECTION TOOLS

For groups wishing to protect wetlands, there are a variety of tools available, although it is not always easy to achieve protected status.

Federal Protection

Wetlands could be included in protected areas established under one of the following Acts.

- ***Canada Wildlife Act*** allows for the establishment of National Wildlife Areas (NWAs).
- ***Canada National Parks Act*** allows for the establishment of national parks, many of which include significant wetland areas.
- ***Oceans Act*** may allow for protection of internal Canadian waters (e.g., tidal wetlands) which support fisheries, including the establishment of Marine Protected Areas.
- ***Migratory Birds Convention Act*** allows for the designation of Migratory Bird Sanctuaries which may include wetlands. The primary focus of this act is for hunting regulations.

Provincial Protection

- ***Wildlife Act*** allows for the designation of Wildlife Management Areas (WMA), Critical Wildlife Areas, and Wildlife Sanctuaries. These may be on Provincial Crown land, or private land leased to the Crown. An example is the Columbia River Wetlands WMA.
- ***Parks Act*** allows for the establishment of provincial parks, many of which include wetland areas.
- ***Ecological Reserves Act*** allows for designation of ecological reserves. This program has a research and educational focus.
- ***Forest and Range Practices Act*** allows for the establishment of Wildlife Habitat Areas (WHAs) and Wildlife Habitat Features (WHFs). WHAs only apply to identified wildlife but some (such as tailed frog) are wetland species. FRPA also includes the following provisions/designations that can directly/indirectly protect wetlands: community watersheds and water quality objectives; fisheries sensitive watersheds and objectives; temperature sensitive streams and species at risk; regionally important wildlife; and ungulate species.

- ***Land Act*** allows for the setting aside of Crown land reserves, sometimes also referred to as wildlife habitat management areas, natural environment areas, and recreation conservation management areas. There are no enforceable measures to protect habitat.
- ***Fish Protection Act*** includes authorities to protect fish and fish habitat including limiting dams on major rivers, designating fish sensitive streams for fish sustainability, and developing sensitive stream recovery plans. However, a number of sections of the Act have not been put into effect.

Local Government Bylaws and Policies

Under the Local Government Act and Community Charter, there are many opportunities for local governments to protect wetlands and other sensitive ecosystems in their community. Examples include:

- **Development Permit Areas** (DPAs) can be identified in official community plans, with guidelines that can require measures to preserve, protect, restore or enhance wetland and riparian areas, and control drainage.
- **Environmentally Sensitive Areas** (ESAs) may be identified in official community plans and regional growth strategies (and are often designated as Development Permit Areas). Use of these areas may be guided through zoning or other bylaws.

  For more information on bylaws to protect wetlands, see the Green Bylaws Toolkit.

Private Land Options

- Conservation covenants are a voluntary legal agreement that allows landowners to permanently protect specified natural and/or cultural features of the land, while still retaining ownership and use. It can cover all or part of a parcel of property. These covenants run with the title of the land and are binding on future landowners. Local governments, some conservation organizations and land trusts are eligible to hold conservation covenants. Conservation covenants are an increasingly popular tool, but have to be well written and regularly monitored to be effective. For more information see *An Introduction to Conservation Covenants A Guide For Developers and Planning Departments*.
- Handshake agreements are simple, informal agreements between a landowner and a conservation organization to protect or manage the land in certain ways (e.g., removing invasive species). For a list of land trust organizations, see

http://www.landtrustalliance.bc.ca/members.html. For a list of conservation and environmental organizations in Canada, see http://www.ec.gc.ca/links/link_assoc_e.html.

- Management agreements are more formal agreements with a simple written contract to manage the land in certain ways. This type of agreement is not binding on future owners. For more information see *Stewardship Options: A Guide for Private Landowners in British Columbia*.
- Land purchase by land trust organizations, sometimes in conjunction with local or senior governments. These lands may be managed by the land trust, or transferred to an appropriate government agency for long term management (usually with a conservation covenant attached to the land title). Lands may be given to land trust organizations. The donor would qualify for tax breaks as an Eco-gift (see http://www.cws-scf.ec.gc.ca/egp-pde/). The Province of British Columbia supports third party acquisition of important habitats through the Habitat Conservation Trust Fund (http://www.hctf.ca/hctf.htm) and other funding sources.