

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

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Regional District of Nanaimo's Drinking Water and Watershed Protection Program

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Table of Contents

1.0 What is a Wetland?	5
2.0 Ecosystem Services	5 – 6
3.0 Wetlands in Decline	6 – 8
4.0 Initial Considerations	8
5.0 Water Governance	8 – 9
6.0 Existing Policy	9 – 26
6.1 Federal Policy	9
6.2 Provincial Policy	11
6.2.1 Riparian Areas Regulation	12
6.3 Local Government Policies and Authority	13
6.3.1 Wetland Ways	13
6.3.2 Official Community Plans	14
6.3.2.1 City of Nanaimo	15
6.3.2.2 City of Parksville	16
6.3.2.3 Town of Qualicum Beach	16
6.3.2.4 District of Lantzville	17
6.3.2.5 Gabriola Island	18
6.3.2.6 Electoral Area ‘A’	18
6.3.2.7 Electoral Area ‘C’	19
6.3.2.8 Electoral Area ‘E’	19
6.3.2.9 Electoral Area ‘F’	20
6.3.2.10 Electoral Area ‘G’	20
6.3.2.11 Electoral Area ‘H’	21
6.3.3 Development Permit Areas	22
6.3.4 Covenants	23
6.3.5 Tax Exemptions	24
6.3.6 Density Bonuses	25
6.3.7 Non-Legislative Tools for Protection and Conservation of Wetlands	25
7.0 Wetland Monitoring Policy Best Practices Review	26 – 33
7.1 Maintain Healthy Wetlands	26
7.1.1 Valuating Natural Assets	26
7.1.2 Land Acquisition	27
7.1.3 Wetland Management Plans	28
7.1.4 Regulatory Approaches	29
7.1.5 Monitoring	30
7.2 Maintain and/or Improve Wetlands that are Important to Important Species	31
7.3 Create Opportunities for the Sustainable Use of Wetlands	31
7.4 Create or Improve Opportunities for Community Engagement	32
8.0 References	34 – 41
Appendix A: Wetland Ecosystem Services Summary	42 – 45

List of Figures

Figure 1. Typical ecosystem services provided by wetlands.	6
Figure 2. Regional District of Nanaimo municipalities and electoral areas.	15
Figure 3. BMCA’s two marshes and the trail that divides them.	27
Figure 4. Student Research Assistants mapping and monitoring a local wetland in the RDN.	31

List of Tables

Table 1. Buffer zone recommendations for wetlands.	13
Table 2. Summary of existing policy regarding wetlands in the City of Nanaimo OCP.	15
Table 3. Summary of existing policy regarding wetlands in the Town of Qualicum Beach OCP.	16
Table 4. Summary of existing policy regarding wetlands in the District of Lantzville OCP.	17
Table 5. Summary of existing policy regarding wetlands in the Gabriola Island OCP.	18
Table 6. Summary of existing policy regarding wetlands in Electoral Area ‘A’ OCP.	18
Table 7. Summary of existing policy regarding wetlands in Electoral Area ‘C’ OCP.	19
Table 8. Summary of existing policy regarding wetlands in Electoral Area ‘E’ OCP.	19
Table 9. Summary of existing policy regarding wetlands in Electoral Area ‘F’ OCP.	20
Table 10. Summary of existing policy regarding wetlands in Electoral Area ‘G’ OCP.	20
Table 11. Summary of existing policy regarding wetlands in Electoral Area ‘H’ OCP.	21

1.0 What is a Wetland?

Wetlands are defined in a number of different ways; however, they are ultimately transitional areas between terrestrial and aquatic systems with wetted soils as a result of surplus water for at least part of the year (Cherry, 2011; Clarkson, Ausseil, & Gerbeaux, 2013). An area is to be classified as a wetland if it contains soils that primarily undergo anaerobic processes, as well as have flora, such as rooted vascular plants, that are adapted to an anaerobic, intermittently flooded environments (Cherry, 2011). Areas are characterized as wetlands as long as they have these stated characteristics, whether they are permanently or temporarily submerged or have fresh, salt, or brackish water (Brander, Florax & Vermaat, 2006). There are many different types of wetlands, including swamps, marshes, bogs, fens, and shallow-water wetlands (Alberta Wetland Policy (AWP), 2019). A wetland is classified based on its defining characteristics; the soil type and dominant flora species are typically the best way to determine the classification of a wetland (AWP, 2019).

2.0 Ecosystem Services

Wetlands cover 52,800 square kilometres of land in British Columbia (B.C.), which is approximately 5% of its landmass (Government of British Columbia, n.d. a). In Canada, wetlands make up 13%, or 1.29 million square kilometres, of the terrestrial area, with the majority of it being in the Boreal Shield (25%), Hudson Plains (21%), and Boreal Plains (18%) (Government of Canada, 2016a). Although wetlands make up large portions of B.C. and Canada, they only cover approximately 1.5% of the Earth's surface, meaning that Canada has around one quarter of the world's wetlands (Clarkson et al., 2013; Government of Canada, 2016a).

The Millennium Ecosystem Assessment defines ecosystem services as “the benefits people derive from ecosystems”, which includes both physical goods and services such as crops, plants, and animals, as well as critical regulating services (International Union for Conservation of Nature (IUCN), 2019, para. 1). As a result of their location within the landscape, wetlands provide up to 40% of the world's ecosystem services; this is disproportionately high when considering the number of ecosystems the Earth contains (Cherry, 2011; Clarkson et al., 2013). Wetlands are considered the second largest ecosystem contributor, only second to coastal estuaries (Cherry, 2011; Mitsch, Bernal & Hernandez, 2015). Wetlands have the capacity to contribute to a large number of natural processes, acting as sources, sinks, conduits, and recipients for both abiotic and biotic resources (Clarkson et al., 2013). At a global scale, wetlands deliver trillions of dollars a year in ecosystem services (Mitsch et al., 2015). In 1997, the Millennium Ecosystem Assessment provided an estimated value of \$14 trillion US for the global ecosystem services in which wetlands provide (Ramsar Convention on Wetlands (RCW), n.d.). More recently, in 2013, *The Economics of Ecosystems and Biodiversity for Water and Wetlands*, a document developed to aid developers in making management and protection

of wetlands a priority, estimated the value of inland wetlands to be as much as US\$44,000 per hectare per year and mangroves and coral reefs valuing as much as US\$215,000 and US\$1,195,000, respectively, per year (Clarkson et al., 2013). Therefore, since the Earth's surface area is 51.01 billion hectares (Universe Today, n.d.) and wetlands cover 1.5% of it, the lowest value associated with wetland's ecosystem services would be approximately US\$33.67 trillion.

Wetlands have a variety of ecosystem services, including: water purification, sediment and nutrient retention, groundwater recharge, maintenance of biodiversity, water quality regulation, storm protection, carbon sequestration, recreation and ecotourism, provide materials for consumption and use, local temperature reduction in urban settings, and cultural values. See Appendix A for an in-depth description of these ecosystem services and examples for each. It should be noted that not every wetland provides all of these ecosystem services all of the time. Different wetlands in different regions of the world are able to contribute different ecosystem services (RCW, n.d.).

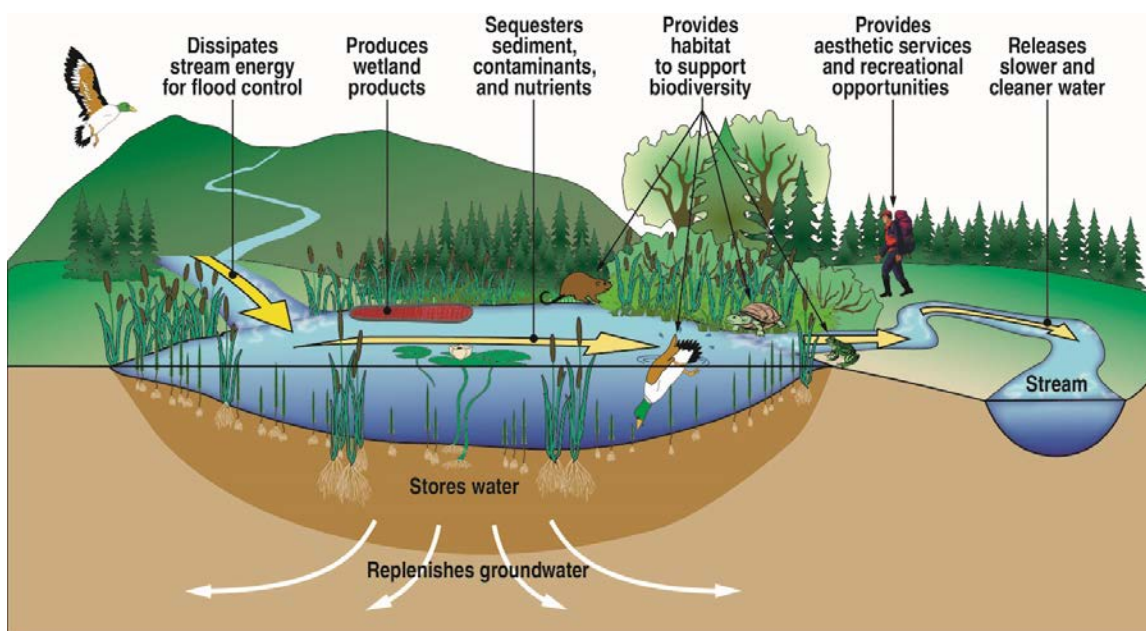


Figure 1. Typical ecosystem services provided by wetlands (Shock, 2016).

3.0 Wetlands in Decline

Unfortunately, despite the extensive list of ecosystem services that wetlands provide, there has been an expeditious decline in wetlands globally, with 64% of the Earth's wetlands eradicated since 1900 (Janse et al., 2018; SCBD, 2015). Humans are the major driver for wetland loss, with the largest impacts being agriculture resulting in excess nutrients, water diversion (i.e., dams, dikes, canalization), pollution (air and water), and land use conversion, primarily in the form of urban development (Janse et al., 2018;

SCBD, 2015). Some of the greatest losses have been in those areas adjacent to urban centres. Although only approximately 0.2% of Canada's wetlands are nearby urban centres, between 80 to 98% of those that are have been lost and subject to land conversion (biodivcanada, 2010). In many parts of the world, short-term gains by the private sector are still continuing to degrade and destruct wetlands (RCW, n.d.). Those wetlands that do remain are still subject to human pressures, either directly or indirectly, through modifications to their hydrology, nutrient overload, and climate change (Clarkson et al., 2013; Janse et al., 2018).

A provincial example of wetland loss has been noticeably occurring since 1800 in the south Okanagan and lower Similkameen valleys of B.C., in the interior. Since there are not many wetlands in the interior, as a result of the existing soils, climate, and topographic features it maintains, they have been found to be an incredibly important ecosystem for many species, providing a place of refuge in many of the arid regions (British Columbia Ministry of Forests Research Program (BCMFRP), 2000). The bulk of the wetlands in this region are found in valley bottoms, the same locations that were congested due to settlement, resulting in a large portion of the existing wetlands being converted for agricultural purposes, and more recently urbanization (Lea, 2008). The loss was immense between 1800 and 2005, losing upwards of 100,000 square kilometres of wetlands, or more than 60% (biodivcanada, 2010; Lea, 2008). Different wetland types were affected to varying degrees of loss, including "92% of shrubby water birch/red-osier dogwood riparian wetlands, 63% of black cottonwood-red osier dogwood riparian wetlands, and 41% of cattail marshes" (biodivcanada, 2010). Unfortunately, the remaining wetlands in the Okanagan region are still at risk to degradation as a result of human activities and land conversion (Lea, 2008).

In B.C., the Agricultural Land Commission (ALC) has allowed wetlands in the Agricultural Land Reserve (ALR) to be drained in order to prepare the land for farming (Simmons, 2019). This work does not need to be approved by government unless it requires alteration to a stream within the area. Given these allowances, wetland losses in the ALR, and more specifically eastern Vancouver Island, the Lower Mainland, and the Okanagan region, have been substantial over the past two decades:

- The marsh habitat along estuaries in the Strait of Georgia have decreased by approximately 60% (WSP, 2010). On eastern Vancouver Island and the Gulf Islands, only 1.7% of the land base remains as natural wetlands (Simmons, 2019).
- In southern Vancouver Island, the Victoria region has lost approximately 70% of their wetlands, primarily due to urbanization (WSP, 2010; Simmons, 2019).
- In the Fraser River Delta, 70% of the original wetlands have been altered by means of diking and draining. Additionally, nearly all of the seasonal wet meadows and approximately 85% of the bog habitat has diminished since 1880 (Wetland Stewardship Partnership (WSP), 2010; Simmons, 2019).

- In the Fraser Valley, one of North America's most productive wetlands, Sumas Lake wetlands (11,700 ha), was drained in the 1920s (WSP, 2010).
- South Okanagan area has lost 85% of their natural wetlands due to housing, agricultural drainage, and stream channelization (WSP, 2010; Simmons, 2019).
- Large proportions of damage and wetland losses in the interior occurred in the mid-1900s. Over 10,000 acres of land, including the Kootenay Flats wetland, were converted to agriculture in the 1930s with the construction of a dam on the Kootenay River (WSP, 2010).

4.0 Initial Considerations

In 1971 the first global, inter-governmental conservation treaty called the *Convention on Wetlands of International Importance* was created (Convention on Biological Diversity, 1992). The *Convention on Wetlands* was the first international treaty dealing with one specific type of ecosystem (North American Wetlands Conservation Council (Canada) (NAWCC), 1999). The Government of Canada signed the treaty in 1981 (NAWCC, 1999). It became apparent that greater influence on land use decisions by the federal departments would be necessary for Canada to meet its commitments under the *Convention on Wetlands*.

In 1992, Canada endorsed the *Convention on Biodiversity* and a federal wetland policy was drafted to form a portion of the implementation initiatives for this international agreement (Convention on Biological Diversity, 1992).

5.0 Water Governance

In Canada, the responsibility for water management is shared by federal, provincial, and municipal governments, and in some instances, by the territories and by Indigenous governments under self-government agreements (Government of Canada, 2016b). This shared responsibility necessitates close cooperation and collaboration among all levels of government, Indigenous peoples, and the public (Government of Canada, 2016b).

Canadian provinces have primary jurisdiction over most of the areas of water management and protection (Government of Canada, 2016b). Many provincial governments delegate certain authorities to municipalities, particularly with regards to drinking water treatment and distribution, as well as wastewater treatment in urban areas (Government of Canada, 2016b). Provincial governments may also delegate some water resource management functions to local authorities that may be responsible for a particular area or river basin (Government of Canada, 2016b).

There are many federal, provincial, and territorial statutes that influence wetland conservation across Canada. These statutes provide authority for agencies to: acquire wetlands for protection; regulate activities on private lands where they interfere with fisheries, migratory birds, or water; require public project proponents to mitigate the

impacts of their projects on wetlands; manage land use by applying by-laws, zoning and sensitive areas designations, such as Development Permit Areas (DPAs); provide tax incentives for conserving wetlands on private lands; and enter into conservation agreements with private landowners (NAWCC, 1999). Policy and legislation surrounding wetlands has evolved in Canada. Wetlands conservation is explicitly mentioned in many more policy documents and legislation, in addition to more organizations using a sustainable development and ecosystem approach as they recognize the broader environmental objectives associated with wetlands (NAWCC, 1999).

6.0 Existing Policy

6.1 Federal Policy

In 1991, the Federal Government approved the *Federal Policy on Wetland Conservation* (Government of Canada, 1991). The objective of the Federal Government wetland policy is to “promote the conservation of Canada’s wetlands to sustain their ecological and socio-economic functions, now and in the future” (National Wetland Policies, 1991, p 5). Their role is to assist “national efforts in wetland conservation through the provision of models, tools and expertise and improving knowledge on the wetland resource of Canada” (National Wetland Policies, 1991, p 4). To reach this objective, the Federal Government, in cooperation with the provinces and territories, have identified the following goals:

- maintenance of the functions and values derived from wetlands throughout Canada;
- no net loss of wetland functions on all federal lands and waters;
- enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels;
- recognition of wetland functions in resource planning, management and economic decision-making with regard to all federal programs, policies and activities;
- securement of wetlands of significance to Canadians;
- recognition of sound, sustainable management practices in sectors such as forestry and agriculture that make a positive contribution to wetland conservation while also achieving wise use of wetland resources; and,
- utilization of wetlands in a manner that enhances prospects for their sustained and productive use by future generations.

Two key commitments within the Policy include: no net loss (NNL) of wetland functions on federal lands and waters through mitigation of all impacts of development related to these wetlands; and enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands has reached critical levels (Government of Canada, 1991).

There are seven strategies included in the Policy, which are facilitated by the *Implementation Guide for Federal Land Managers* (Government of Canada, 1991):

1. *Developing Public Awareness* – promote public awareness and understanding of wetland resources.
2. *Managing Wetlands on Federal Lands and Waters and in other Federal Programs* – focus on areas where degradation is critical, promoting conservation and sustainable use.
3. *Promoting Wetland Conservation in Federal Protected Areas* – the Federal Government will manage protected areas, previously established for conservation, to sustain wetland functions.
4. *Enhancing Cooperation* – focusing and building on partnerships with programs, which identify geographic areas susceptible to degradation, wetlands requiring protection, and management strategies for use of wetland resources.
5. *Conserving Wetlands of Significance to Canadians* – focus on wetlands that represent full range of functions and types, and importance to Canadians.
6. *Ensuring Sound Scientific Basis for Policy* – developing a basis for wetland conservation and working on the accessibility of said information necessary for wetland conservation.
7. *Promoting International Actions* – building relationships internationally, with organizations and nations, for sustainable use of wetlands and encouragement of wetland conservation globally.

A supplementary document, *Implementing “No Net Loss” Goals to Conserve Wetlands in Canada* (1992), outlines various recommendations for these goals in four jurisdictional areas that have already put procedures into place to support the goal of NNL.

Incorporating the NNL goal as part of the review process for project approval is an initial first-step in changing the way decisions are made. This guide outlines 6 recommendations for implementing NNL policies in North America, reflecting on advice from jurisdictions already working on the goal:

1. *Regional focus for NNL* – encompassing “like” wetlands can ensure more success with the NNL goal.
2. *Stakeholder involvement* – involving the key stakeholders and producing techniques that each can contribute to will boost chances of success.
3. *Mechanisms to target major cause of wetland loss* – develop a program that can influence wetland decisions and result in change.

4. *Ecological functions for NNL implementation focus* – while NNL is defined to include wetland function and area, it's really the focus on function and value that is imperative.
5. *Advance planning for NNL implementation* – the benefits to advance planning can be both environmental and economic.
6. *Mitigation directives* – minimizing the fear that groups will destroy a wetland entirely with the promise of fixing it in the future.

Training programs have been developed by the North American Wetlands Conservation Council and the Canadian Wildlife Service to help land managers implement the federal wetland policy.

6.2 Provincial Policy

The Government of B.C. employs a suite of policies and strategies in the pursuit of protecting the Province's natural capital; some of the spin-off effects are directly related to protecting, restoring, and maintaining wetlands. Strategies include initiatives concerning biodiversity conservation, for example establishing Wildlife Management Areas, and the 2017 government mandate to enact a species at risk law (WSP, 2009; Government of Canada, 2017). While the legislation for the species at risk law is developed, a combination of provincial laws govern how populations and habitats are managed; these include:

- *Wildlife Act* - used to protect habitat for endangered and threatened species as "Critical Wildlife Habitats in Wildlife Management Areas" (Wildlife Act, 1996).
- *Forest and Range Practices Act* - species at risk can be maintained through the establishment of Wildlife Habitat Areas (WHAs) and General Wildlife Measures (GWMs) under the Government Actions Regulation (Forest and Range Practices Act, 2002).
- *Ecological Reserves Act* – provides a framework for the establishment and administration of ecological reserves for many reasons, including protecting critical habitat. They are established by including them in the schedules of the Protected Areas of *British Columbia Act* or by an order in council (Ecological Reserves Act, 1996).
- *Park Act* –for the establishment of parks, conservancies, and recreation areas in existing parks, conservancies and recreation areas. The Park, Conservancy and Recreation Area Regulation address the management and protection of these spaces (Parks Act, 1996).
- *Land Act* – protects species at risk and their habitat with mapped reserves and land use orders or permits as part of land use planning agreements (Land Act, 1996).
- *Water Act* – governs all works in or around streams (Water Act, 1996).

- *Environmental Assessment Act* – gives the Ministry of Environment and Climate Change Strategy the authority to develop guidelines and standards to protect wetlands that have been or might be impacted by waste. The Municipal Sewage Regulation controls the use of reclaimed water and its permitted uses (Environmental Assessment Act, 2002).
- *Canadian Species and Risk Act* (Federal) – provides legal protection for federally listed wildlife species and the conservation of their biodiversity (Government of Canada, 2017).

Local governments and various agencies rely on the provincial government to administer the above acts to support their wetlands conservation.

6.2.1 Riparian Areas Regulation

The Riparian Areas Regulation (RAR) was enacted under Section 12 of the *Fish Protection Act* and was renamed the *Riparian Areas Protection Act* in 2016 (Government of BC, 2019). The RAR calls on Local Governments to protect riparian areas during development by ensuring that a Qualified Environmental Professional (QEP) conducts assessments on proposed development sites (Government of BC, 2019). If a QEP determines that harm cannot be avoided in development, then the applicant must submit an application to Fisheries and Oceans Canada (Government of BC, 2019).

Section 3(1)(h) of the *Riparian Areas Protection Act* designates the Regional District of Nanaimo as a geographical area in which the RAR applies (Government of Canada, 2019). If used to its potential, the RAR can be used as a tool that gives local governments' greater authority to conserve and protect the riparian areas, including wetlands.

Section 1 *Definitions* define “wetlands” as “land that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens, estuaries and similar areas that are not part of the active floodplain of a stream” (Government of Canada, 2016c).

Local governments can use a host of legislative tools to support the RAR, including:

- Official Community Plans - can establish policies for the preservation, protection, restoration and enhancement of the natural environment, its ecosystems and biological diversity;
- Development Permit Areas;
- Zoning bylaws - a zoning bylaw can establish riparian protection in the form of “setbacks”, in which structures are restricted and can restrict lot sizes;
- Subdivision bylaws - local governments have the authority to adopt bylaws regarding the provision of works and services as part of a subdivision;
- Development approval and information bylaws;

- Covenants; and,
- Other regulatory bylaws affecting land use.

6.3 Local Government Policies and Authority

Local Governments are afforded powers to govern over land through different acts and legislation. These powers can be used in a variety of often creative ways for the protection, conservation, and management of wetlands.

6.3.1 Wetland Ways

Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia, developed by the Wetland Stewardship Partnership, provides practices to protect and maintain wetlands and to increase wetland area in B.C.. This document provides a roadmap for maintaining the high ecological values of wetlands and to prepare for those who are planning activities near wetlands (WSP, 2009). This document generally describes how to inventory and assess wetlands; how to protect wetlands with buffer zones; how to minimize impacts from nearby activities; and, how to protect water quality and quantity through its 13 chapters; these topics are summarized below:

1. *Inventory and assessment of wetlands* – the goal of wetland inventory and assessment is to provide enough information to make sound scientific decisions prior to any activities taking place near the wetland. Inventory and assessment include four main steps: preliminary site survey, bio-inventory, conservation evaluation, and impact assessment.
2. *Buffer zones* – are areas surrounding the wetland that contain undisturbed natural habitat. The purpose of a buffer zone is to protect the wetland and all of its functions (Table 1). Buffer zones are beneficial for: filtering sediment and toxins, mitigating flood impacts, preventing erosion, providing habitat, and enhancing views and recreational activities.

Table 1. Buffer zone recommendations for wetlands (WSP, 2009).

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

3. *Minimizing impacts from nearby activities* – areas adjacent to wetlands can be important wildlife habitat for feeding and breeding. Activities in these areas can directly affect the wetland, depending on the activity (e.g. roads, industrial or urban development, etc.), proximity to wetland, soil and slope, and reliability of the wetland buffer. Do not develop in upland areas that are integral to the wetlands function, such as wildlife corridors. If development does occur, ensure that it is during a “least risk window”, or a time when species are more tolerant of disruption. Specific least risk windows for wetlands can be found on the Government of British Columbia’s website (Government of British Columbia, n.d. b).
4. *Protecting water quality* – although water quality standards may differ for different types of wetlands and at different locations, altering the quality of incoming water could change the wetland’s turbidity, colour, odour, pH, pathogenic organisms, sediment load, and nutrient load. It is important to measure these variables prior to any development that may impact the wetland using the B.C. Water Quality Guidelines (Government of British Columbia, n.d. d).
5. *Protecting water quantity* – altering how much water enters or leaves a wetland can significantly change the function of the system. Water inflow and outflow must be maintained to prevent erosion and/or increasing flood levels. It is also recommended not to excavate or fill the wetland as it can lead to displaced flooding or breach of soil layers.

With respect to groundwater, it is recommended to prevent impervious surfaces and compaction of the ground. As well, paved and cement surfaces should be avoided, they prevent rainwater from reaching the ground below the wetland. Finally, when developing lands nearby wetlands, use techniques to promote groundwater recharge (e.g. infiltration ponds, permeable paving, green roofs, and rain-gardens that treat runoff before entering the wetland).

This document also provides a summary of relevant wetland legislation in B.C., an interpretation of the policy, and, in some cases, examples of how local governments have used legislation to forward their conservation efforts. For example, under the *Weed Control Act* (1996), the Comox Valley Regional District listed purple loosestrife (*Lythrum salicaria*) as “noxious”. Purple loosestrife is an invasive wetland perennial that outcompetes the majority of native wetland species and can even block water flow into the wetland.

6.3.2 Official Community Plans

An Official Community Plan (OCP) outlines broad objectives and policies of local governments (Regional District of Nanaimo (RDN), 2019). It is a long-term strategy for

land use, development, and servicing, as well as lands that are environmentally sensitive, including wetlands. The Regional District of Nanaimo (RDN) has 5 municipalities with their own OCPs: City of Nanaimo, City of Parksville, Town of Qualicum Beach, District of Lantzville, and Gabriola Island. Additionally, the RDN has 6 Electoral Areas with their own OCPs: Electoral Area ‘A’, Electoral Area ‘C’, Electoral Area ‘E’, Electoral Area ‘F’, Electoral Area ‘G’, and Electoral Area ‘H’. Below is a summary of each OCPs objectives and policies that reference wetlands. Note that in some cases the OCPs reference environmentally sensitive areas or surface water that pertain to wetlands, but only objectives and policies that specifically use the words wetlands, swamps, or marshes, was included in this summary.

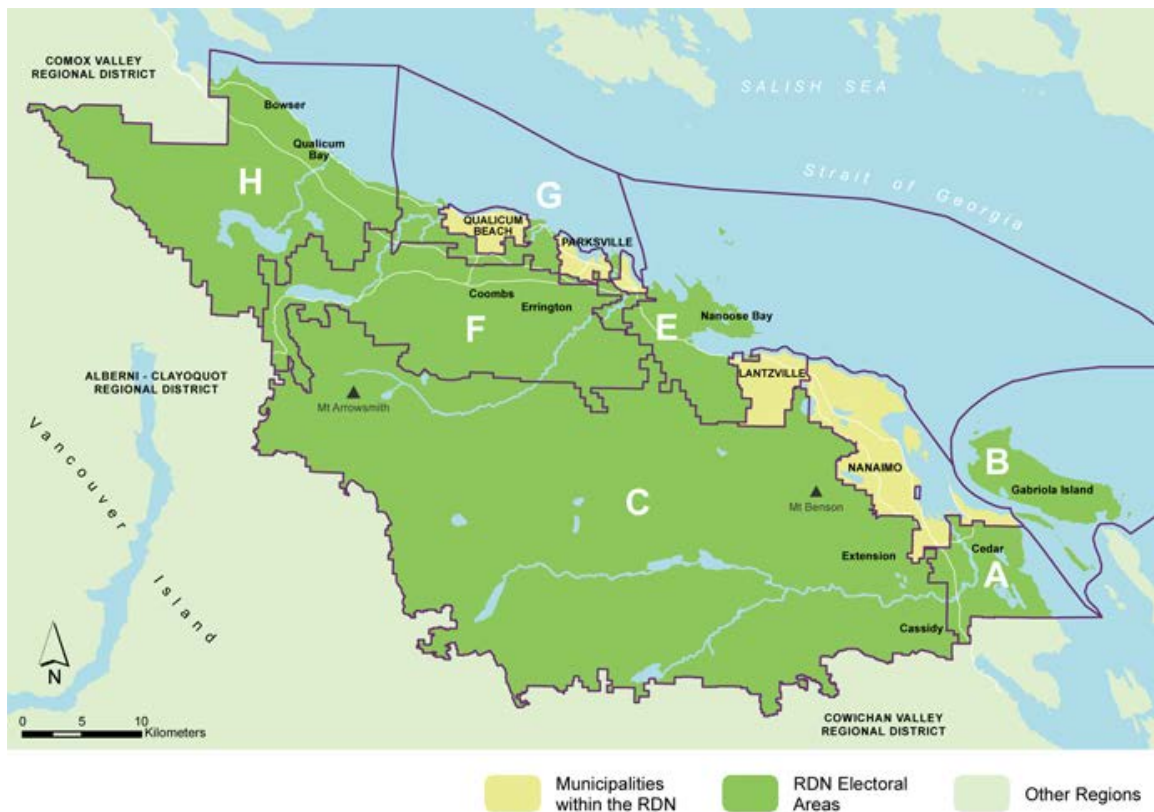


Figure 2. Regional District of Nanaimo municipalities and electoral areas (RDN, 2019c).

6.3.2.1 City of Nanaimo

Policy specifically pertaining to wetlands in the City of Nanaimo OCP is listed below (City of Nanaimo, 2008):

Table 2. Summary of existing policy regarding wetlands in the City of Nanaimo OCP.

OCP Subsection	Policy
2.6 Urban Reserves	Policy “4) An Area Plan for lands within an Urban Reserve designation will be prepared to provide a comprehensive plan for

	land uses (including residential, parks and open spaces, and supporting commercial), environmental protection (including wetlands and steep slopes), servicing, integrated stormwater management, transportation, and timing of development.”
2.10 Resort Centre	Policy “6) Development of a Resort Centre will address goals for protection, enhancement, or mitigation of disturbance of environmentally sensitive areas (including wetlands, watercourses and associated drainages), through the development permit approvals process.”
5.5 Erosion Control	Policy “1) “Standards and procedures will be developed to address erosion control during and after construction. Guided by the federal and provincial Land Development Guidelines for the Protection of Aquatic Habitat (1993), these standards will address: soil conditions and topography considerations in site design, layout and construction; scheduling of clearing and construction activities to avoid rainfall seasons; phasing of construction activities to retain natural cover and avoid large expanses of denuded land; limits on areas affected by development activities; vegetation retention and replacement (seeding, hydroseeding, etc.); protective fencing; surface stabilizers such as mulch, organic mats, tarps, etc.; runoff diversion into ditches, swales; runoff velocity reduction measures (gradient reduction, interceptor ditches and fences, benches and breaks, etc.); temporary sediment detention ponds; and permanent stormwater control structures (dry/wet detention ponds, constructed wetlands).”

6.3.2.2 *City of Parksville*

The City of Parksville OCP makes note of wetlands on multiple occasions in the document, however there are no policies specially pertaining to wetlands (City of Parksville, 2013).

6.3.2.3 *Town of Qualicum Beach*

Policy specifically pertaining to wetlands in the Town of Qualicum Beach OCP is listed below (Town of Qualicum Beach, 2018):

Table 3. Summary of existing policy regarding wetlands in the Town of Qualicum Beach OCP.

OCP Subsection	Policy
2.2.6 Rural	Policy “11) In the westerly part of Qualicum Beach: iv. The Town, in approving any development proposed for the West Qualicum Beach Open Space Development Area, as shown on map ‘Schedule 2.1’, commits to protect the wetlands identified in SE1 Polygons N0409 and N0411 and supports the registration of a conservation covenant in favour of a third party, with an upland

	<p>buffer of 200 m around the wetland where possible. The upland buffer may be reduced to 50 m in certain locations, depending on the locations and circumstances, to foster a proposal for clustered development.</p> <p>vi. The Town, being the level of government with the delegated legislative authority, shall protect the wetlands identified in SEI polygons N0409 and N0411. The Town acknowledges ecological protection and buffers of wetlands differ from the RAR of rivers, creeks and streams and recognizes our authority to impose more restrictive requirements (i.e. 200m buffer around wetlands) than other levels of government, including the Province’s Develop With Care Guidelines, so long as these do not impose mutually contradictory requirements or prevent development of the cluster development area as described previously in this section.”</p>
2.2.8 Recreational Greenways	<p>Policy 1) “Ecological Greenways shall include four types: ‘Greenbelt Area and Working Landscapes’ around the outskirts of the Town, protected by advocacy policies and zoning; ‘Aquatic Habitat Greenways’ to protect watercourses, wetlands and associated riparian vegetation and aquatic ecosystems; ‘Upland Habitat Greenways’ to protect lands with steep slopes, to provide representative samples of local upland ecosystems, to maintain buffers along key roadways, and to conserve sensitive terrestrial ecosystems; [and] ‘Parks and Open Space Area’, which includes the Community Park and also neighbourhood parks, in the east and west areas of the Town. Open space includes local golf courses and undeveloped portions of the E&N railway and Village Way.”</p>
2.5.3 Stormwater and Watershed Management	<p>Policy “4) The Town shall encourage the retention of existing wetlands and the construction of artificial wetland(s) in the upper reaches of the Creeks where it is feasible and practical.”</p>

6.3.2.4 District of Lantzville

Policy specifically pertaining to wetlands in the District of Lantzville OCP is listed below (District of Lantzville, 2019):

Table 4. Summary of existing policy regarding wetlands in the District of Lantzville OCP.

OCP Subsection	Policy
8.4.1 Site Development Planning	<p>Policy 1) “The District will require, as part of the application, that environmentally sensitive areas, hazard areas, rare vegetation, wildlife habitat, watercourses, significant wetlands, archaeological sites, and critical viewpoints be identified, preserved, and protected from the impacts of development.”</p>

6.3.2.5 Gabriola Island

Policy specifically pertaining to wetlands in the Gabriola Island OCP is listed below (Islands Trust, 2019):

Table 5. Summary of existing policy regarding wetlands in the Gabriola Island OCP.

OCP Subsection	Policy
6.1 Environmentally Sensitive Areas	Policy “d) In order to protect area watercourses, rezoning adjacent to a watercourse shall be conditional upon the establishment of a protective setback area. The Ministry of Environment - Federal Fisheries report titled: Stream Stewardship - A Guide for Planners & Developers and Land Development Guidelines for the Aquatic Habitat shall be used as a guideline in determining how land is to be developed adjacent a watercourse (including a lake and wetland).”
7.1 Land Transportation	Policy “f) New roads, and modifications to existing roads, should not fragment agricultural land or environmentally sensitive areas, such as wetlands.”

6.3.2.6 Electoral Area ‘A’ (Cassidy, Cedar, Yellow Point, and South Wellington)

Policy specifically pertaining to wetlands in the Electoral Area ‘A’ OCP was found in 4.0 *Protecting the Natural Environment* under the following subsections (RDN, 2011):

Table 6. Summary of existing policy regarding wetlands in Electoral Area ‘A’ OCP.

OCP Subsection	Policy
4.1 Environmentally Sensitive Ecosystems and Species of Concern	“Policy 4.1.5 Designate DPA’s in Section 12 of this plan to protect the following sensitive ecosystem types: riparian vegetation, wetland, coastal bluff, terrestrial herbaceous, and older forest as defined in the ESA atlas.”
4.2 Freshwater Management	“Policy 4.2.6 The RDN shall support the use of protective measures such as return to Crown, covenants, or conservation agreements for riparian corridors and along the bed of watercourses, creeks, lakes, and wetlands wherever development on adjacent land is proposed.”
4.4 Drinking Water Protection and Groundwater Resources	“Advocacy Policy 4.4.20 The provincial government is requested to introduce legislation to govern the management of groundwater resources to ensure that: a. The rate of groundwater withdrawal does not exceed the rate at which the sources are recharged; b. There is an adequate allotment of water earmarked for agricultural use; and, c. The human use of ground or surface water does not have negative impacts on fish and wildlife, or on the recreation potential of a creek, river, or significant wetland.”
4.5 Rainwater Management	“Policy 4.5.6 Development or subdivision of land must where practical be designed to: a. Replicate the function of a naturally vegetated watershed; b. Maintain the hydrological regime of surface and groundwater and predevelopment flow rates; c. Minimize interference with groundwater recharge; and, d. Not introduce or

	remove materials where it would cause erosion of or the filling in of natural watercourses and/or wetlands.”
4.5 Rainwater Management	“Advocacy Policy 4.5.7 The Regional District shall request that the Approving Officer require subdivisions to be designed to maintain the hydraulic regime of streams and watercourses while providing sufficient drainage in a manner which does not interfere with groundwater recharge or allow erosion materials into natural watercourses, lakes, and wetlands.”

6.3.2.7 Electoral Area ‘C’ (Nanaimo Lakes and East Wellington)

Policy specifically pertaining to wetlands in the Electoral Area ‘C’ OCP is listed below (RDN, 2018a):

Table 7. Summary of existing policy regarding wetlands in Electoral Area ‘C’ OCP.

OCP Subsection	Policy
Goal 4 – Protect the Natural Environment	Policy “1) Known watercourses including rivers, streams, lakes, marshes and swamps are as shown on Map No. 3, Inventory of Natural Environmental Features, Sheet 1 of 1.”
Goal 4 – Protect the Natural Environment	Policy “5) The dredging, filling or channeling of any watercourse including rivers, streams, lakes, marshes or swamps, will not be supported unless undertaken, supervised or approved by the Provincial Ministry of Environment, Lands and Parks or the Federal Department of Fisheries and Oceans.”
Goal 7 – Improve Service and Resource Use Efficiency	Policy 2) “Community storm water management will be in accordance with the following criteria: a) Where appropriate, natural drainage systems, including constructed wetlands and biofiltration ponds, will be used in accordance with the Ministry of Environment, Lands and Parks, Land Development Guidelines for the Protection of Aquatic Habitat.”

6.3.2.8 Electoral Area ‘E’ (Nanoose, Fairwinds, and Schooner Cove)

Policy specifically pertaining to wetlands in the Electoral Area ‘E’ OCP were found in in *Section II – Protection of the Environment* (RDN, 2018b):

Table 8. Summary of existing policy regarding wetlands in Electoral Area ‘E’ OCP.

OCP Subsection	Policy
2.1 Environmentally Sensitive Areas	Policy “2) Environmentally sensitive areas or sensitive ecosystems include eagle nesting and perch trees, heron roosts, watercourses and riparian habitats, wetlands, and the seven sensitive ecosystems as identified in the Sensitive Ecosystem Inventory: East Vancouver Island and Gulf Islands 1993-1997 including Woodland, Coastal Bluff, Terrestrial Herbaceous, Wetland, Riparian, Sparsely Vegetated, and Older Forests, as well as two ‘other important

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

	ecosystems’ Older Second Growth Forest and Seasonally Flooded Agricultural Field.”
2.1 Environmentally Sensitive Areas	Policy “3) The protection of Woodland, Coastal Bluff (for lands that are subdividable), Terrestrial Herbaceous, Wetland, and Sparsely Vegetated is supported through the establishment of Development Permit Areas as shown on Map No. 6.”

6.3.2.9 Electoral Area ‘F’ (Errington, Coombs, and Hilliers)

Policy specifically pertaining to wetlands in the Electoral Area ‘F’ OCP were found in in *Section 4 – The Natural Environment* under the following subsections (RDN, 2018c):

Table 9. Summary of existing policy regarding wetlands in Electoral Area ‘F’ OCP.

OCP Subsection	Policy
Environmentally Sensitive Areas	“General Policy 5) Discourage the filling and draining of wetlands.”
Surface and Groundwater Systems	“General Policy 1) Storm water management through the use and construction of settlement ponds, structured wetlands, dugouts and other measures is supported.”
Surface and Groundwater Systems	General Policy 2) “The restoration of streams, rivers, wetlands and adjacent riparian areas through stream protection and repair programs is encouraged in this Plan.”

6.3.2.10 Electoral Area ‘G’ (French Creek, Englishman River, Dashwood, and San Paniel)

Policy specifically pertaining to wetlands in the Electoral Area ‘G’ OCP were found in in *2.0 – Protecting the Natural Environment* under the following subsections (RDN, 2008):

Table 10. Summary of existing policy regarding wetlands in Electoral Area ‘G’ OCP.

OCP Subsection	Policy
2.1 Environmentally Sensitive Ecosystems	Policy “5) Require return to Crown Land, or apply protective covenants or conservation agreements for riparian corridors along the bed of watercourses, creeks, lakes and wetlands wherever development on land adjacent to these features is proposed.”
2.2 Freshwater Management	Policy “5) Require Return to Crown, or apply protective covenants or conservation agreements for riparian corridors along the bed of watercourses, creeks, lakes and wetlands wherever development on adjacent land is proposed.”
2.7 Rain Water Management	Policy “1) Development or subdivision of land must be designed to: a. Replicate the function of a naturally vegetated watershed; b. Maintain the hydrological regime of surface and groundwater and pre-development flow rates; c. Minimize interference with groundwater recharge; and, d. Not introduce or remove materials where it would cause erosion of or the filling in of natural watercourses and/or wetlands.”

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

2.7 Rain Water Management	“Advocacy Policy 10) The Regional District shall request that the Approving Officer require subdivisions to be designed to maintain the hydraulic regime of streams while providing sufficient drainage in a manner which does not interfere with groundwater recharge or prevent the intrusion of erosion material into natural watercourses, lakes and wetlands.”
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6.3.2.11 Electoral Area ‘H’ (Deep Bay, Bowser, and Qualicum Bay)

Policy specifically pertaining to wetlands in the Electoral Area ‘H’ OCP were found in in *Section 2 – The Natural Environment* under the following subsections (RDN, 2017):

Table 11. Summary of existing policy regarding wetlands in Electoral Area ‘H’ OCP.

OCP Subsection	Policy
2.1 Sensitive Ecosystems	“Advocacy Policy 9) The habitat protection initiatives of the BC Ministry of Environment and Fisheries and Oceans Canada along rivers, streams, and wetland areas shall be strongly supported and complemented with Regional District park land and greenway protection initiatives.”
2.3 Freshwater Resources	Policy “1) Streams, lakes, wetlands and aquifer areas are designated as Development Permit Areas to allow for evaluation of development proposals pursuant to the objectives of this section. Both mapped and unmapped streams are included in the development permit area, and where streams move over time or mapping accuracy is improved, mapped streams will be updated on maps in the Plan.”
2.3 Freshwater Resources	“Advocacy Policy 5) The Regional District shall request that the Approving Officer require subdivisions to be designed to maintain the hydraulic regime of streams while providing sufficient drainage in a manner which does not interfere with groundwater recharge or allow the intrusion of erosion material into natural watercourses, streams, lakes, and wetlands.”
2.3 Freshwater Resources	“Advocacy Policy 6) The Regional District shall encourage the Approving Officer to require protective covenants or the designation of Return to Crown along the bed of, and buffering riparian corridor of watercourses, streams, creeks, lakes and wetlands wherever subdivision on adjacent land is proposed. The Regional District shall encourage the Ministry of Forests, Lands and Natural Resources Operations to ensure a future use of the Bowser Seed Orchard lands that contribute to the protection of aquifer and community water supply wells.”
3.2 Forestry	“Advocacy Policy 3) The Province and private forest land owners shall be encouraged to manage their forest lands so that they do not: a. Pose a threat to the quantity and quality of fresh water within the drainage system of watercourses, streams, lakes or wetlands; b. Alter the aesthetic appeal and visual integrity of the Plan Area; c. Disturb

	areas of unique vegetation or wildlife; and, d. Increase, or contribute to, soil erosion.”
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6.3.3 Development Permit Areas

The *Local Government Act* gives local governments, such as Regional Districts, the authority to designate areas of land as DPAs within their OCPs to be used for one or more purposes (Local Government Act (LGA), 2015). As per Section 488(1)(a), one of these purposes includes the “protection of the natural environment, its ecosystems and biological diversity” (LGA, 2015).

Local governments across B.C. have designated DPAs for the protection of riparian areas, mapped watercourses, such as rivers and lakes, and the protection of wetlands. These policies are triggered in the event that a landowner wishes to develop his or her land, which may include the building upon or subdivision of land, on property with areas designated as DPAs. A local government may require that the applicant apply for a Development Permit, whereby the applicant is responsible for fulfilling the Local Governments policies. This may include restricting the permissible distance the applicant may build from the marked watercourse or requiring the applicant to present a report from a QEP indicating that the development will not negatively impact the natural environment. Local governments have the authority to use this power to the extent approved by the Board or Council, assuming that it is legally permissible (LGA, 2015).

An example of a DPA specific to wetlands is the Streamside Development Permit Area (SDPA) in Saanich, B.C. (District of Saanich, 2019). The SDPAs purpose is to protect the lands near a creek, stream, or wetland from development and restore streamside areas to improve fish and wildlife habitat. The District implemented the SDPA in 2006 in accordance with the Riparian Areas Regulation. Citizens are prohibited from altering, subdividing, or starting construction within 30 metres of a creek, stream, or wetland without a permit. The SDPA, developed in Saanich, is similar to the Watercourses Development Permit Area implemented by the City of Nanaimo Nanaimo, the Watercourse Protection Development Permit Area developed by the District of Lantzville, and the Riparian Areas Development Permit Area enforced by Gabriola Island.

Another example of a DPA is the Freshwater and Fish Habitat DPA designated by the RDN (Regional District of Nanaimo, 2019a). As stated in all 6 of the RND’s Electoral Area OCPs, the DPA applies to riparian areas of mapped and unmapped streams subject to the RAR of the *Riparian Areas Protection Act*, in addition to all mapped wetlands, lakes, ponds, and watercourses not subject to the RAR. For all mapped and unmapped riparian assessment areas as defined in the RAR, a DPA is required for development within 30 metres of a stream measured from the high water mark, including any wetland that provides fish habitat. For all mapped wetlands, lakes, ponds, and watercourses that

are not subject to the RAR, a DPA of 15 metres, as measured from the natural boundary, applies.

6.3.4 Covenants

Part 14 of the *Land Title Act* gives local governments the authority to impose covenants (Land Title Act, 1996). Covenants are legal agreements on a property's title that allow land owners to permanently protect environmental or cultural features on their land. There are two types of covenants that a local government can use: restrictive and conservation covenants. Local governments can impose restrictive covenants but conservation covenants must be agreed to voluntarily. Some local governments have offered tax exemptions to landowners who register a covenant to protect ecological features (Islands Trust Conservancy, 2018). For example, Islands Trust offers the Natural Area Protection Tax Exemption Program (NAPTEP). The program allows for an annual tax exemption of 65% of the assessed value of land protected with a conservation covenant. The covenant encourages landowners to protect important features (e.g. wetlands, old growth forests, coastal bluffs, and key habitat areas) while helping local governments to not spend tax revenue to purchase the land. To apply for NAPTEP, the landowner registers for a conservation covenant with the Islands Trust Conservancy on the title of their property. When the property has a covenant, they are eligible for a Natural Area Exemption Certificate.

The Land Conservancy (TLC), a non-profit charitable Land Trust, works to protect vital habitats for plants, animals, and natural communities with critical value throughout B.C.. They have implemented dozens of covenants throughout B.C., including Vancouver Island and the Gulf Islands. The legal agreement between the landowner and conservation organization are attached to the property forever, regardless of changing ownership. A few local and regional examples of covenants are provided below:

- The Kinghorn property, in the Capital Regional District's Mount Work Regional Park, has been protected by a conservation covenant since 2009. In total, 64 ha of forest and wetlands are preserved, ensuring critical habitat for native plant species and wildlife will remain (The Land Conservancy (TLC), 2016).
- On Galiano Island, 10 ha of forested areas, stream systems, Garry oak ecosystems, and wetlands are under the Millard Covenant since 2005. Disturbances have diminished since logging ceased approximately 60 years ago, but protection of the area has ensured an enhancement on the connectivity to adjacent protected land, improving ecological integrity (TLC, 2016).
- On Thetis Island, the Ralston Property Covenant, in effect since 2002, protects approximately 10 ha of forested land with a large wetland on its western boundary (TLC, 2016).
- In Comox, 3.5 ha of Wildwood Marsh was covenanted in 2004 (TLC, 2016). Also

known as Burns Marsh, this piece of land contains the headwaters of a fish-bearing stream. Additionally, the marsh provides critical habitat for 44 species of birds, mink, muskrat, deer, grouse, beavers, elk, bear, cougars, and wolves. The covenant not only works to protect the wildlife habitat but also maintenance of the water level on the land.

6.3.5 Tax Exemptions

Tax exemptions are another means for local governments to contribute to the conservation of wetlands in their region. A program offered by some local governments is the riparian tax exemption, which allows the landowner property tax exemption along a watercourse or lake (Habitat Acquisition Trust, 2004). The exemption is a voluntary covenant and only applies to the area that is riparian. In 2003, the Town of Gibsons used this program as an incentive to restore Charman Creek (Curran et al., 2016).

Islands Trust Conservancy offers the Natural Area Protection Tax Exemption Program (NAPTEP) to the islands that fall within their region in the Salish Sea. The NAPTEP provides landowners with an annual 65% exemption on property taxes (Islands Trust Conservancy, 2019). This program encourages landowners to protect their land and reduce development. Qualifying properties must obtain a conservation covenant prior to the tax exemption application. Similarly, the Strathcona Regional District implements tax exemptions on environmentally sensitive areas. Since 2010, a property on Quadra Island has been granted tax exemption each year as it possesses an environmentally sensitive wetland on the property (Leitch, 2018). Since the protected wetland area provides habitat for wildlife and indigenous flora, the tax exemption benefits the entire community.

In Ontario, protecting important natural areas is the driving force behind a tax incentive program. The Conservation Land Tax Incentive Program was developed to protect provincially significant natural areas (Ministry of Natural Resources and Forestry (MNR), 2019). These areas must be approved by the Ministry of Natural Resources and Forestry and can include: areas of natural and scientific interest; habitats housing endangered species; wetlands; and community conservation lands. While there are specific criteria that need to be met and approval needs to be granted, landowners can request their area of interest to be considered. If the property in question has eligible natural heritage features, landowners may qualify for a 100% property tax exemption. Inspections of the land occur on an annual basis (MNR, 2019).

Similar to Ontario's Conservation Land Tax Incentive Program, Oregon's Department of Fish and Wildlife (ODFW) have developed a Riparian Lands Tax Incentive (Oregon Department of Fish and Wildlife (ODFW), 2015). If property owners work to improve or maintain riparian lands that satisfy the requirements outlined, they are eligible for property tax incentives (ODFW, 2015). Complete tax exemptions are offered for qualifying riparian properties. Focusing on the social and economic well-being of the state and its citizens, protecting and rehabilitating riparian lands is the driving force

behind the incentive law (ODFW, 2015). By conserving these lands and thus the conservation of soil, water, fish, and wildlife resources, the provision of cooler water from shading, increased suitable habitat for salmon species and other wildlife, increased water during dry summers, and erosion and flood control are also conserved (ODFW, 2015).

Other incentives for conservation include ecological gifts. Some governments have offered ecological gifts as an incentive program that promotes landowners to donate full title of a property or a registered conservation covenant with environmentally sensitive land (e.g. streams and wetlands) (Habitat Acquisition Trust, 2004). Property owners are eligible to receive federal and provincial tax assistance for the donations. This was the case in the Village of Cumberland, B.C., when a private forestry company donated a property that had sensitive wetlands on the site.

6.3.6 Density Bonuses

Local governments in B.C. have offered density bonuses to developers in return for setting aside environmentally sensitive areas (Curran et al., 2016). A density bonus allows for greater density to be built on a site than what would typically be allowed. Developers are often granted as an incentive to encourage preferred types of development. Density bonusing can be included in zoning bylaws as an option subject to specific conditions. The District of Highlands, outside of Victoria, B.C., offers density bonuses to landowners and developers in an attempt to maintain large ecologically sensitive habitats, including wetlands (Curran et al., 2016). In Burnaby, B.C., density bonus policies have been added into their zoning bylaws with regards to the implementation of green infrastructure. According to bylaws, rehabilitation of riparian areas satisfies the criteria for green infrastructure (Curran et al., 2016). By way of creation or enhancement of a City park adjacent to development, developers can receive these density bonuses.

6.3.7 Non-Legislative Tools for Protection and Conservation of Wetlands

Other non-legislative tools for the protection and conservation of riparian areas include information and education about stream and wetland stewardship, watershed or integrated stormwater management plans, parkland acquisition, tax incentives, and landowner agreements.

Project Watershed, a non-profit environmental society, is guided by a volunteer board and promotes community stewardship in Comox Valley Watersheds through education, information, and action (Project Watershed, 2018a). Since 1993, Project Watershed has offered volunteers the opportunity to participate in Streamkeeper and Wetlandkeeper courses in addition to educating the public on the importance of wetlands (Project Watershed, 2018a). Their nationally recognized Streamkeepers course focuses on monitoring aquatic habitats through habitat surveys, water quality testing, sampling, and

identifying aquatic invertebrates. Completion of the course results in a Streamkeeper certificate (Project Watershed, 2018b). The Wetlandkeepers course covers all types of wetlands and includes estuaries where participants learn to map and identify wetlands, and conduct plant and bird inventories. A Wetlandkeepers certificate is awarded upon completion (Project Watershed, 2018b). In addition, Project Watershed helps the volunteers in continuing this important work by involving them in local volunteer projects.

7.0 Wetland Policy Best Practices Review

A review of local government and non-governmental organizations policies and action plans showed that identifying and mapping wetlands was the first step that most organizations took towards adopting policies to preserve, conserve, or restore them. Most completed the mapping exercise in the most economically viable way, by acquiring and analyzing Terrain Resource Information Management (TRIM) data (Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), 2017). Many organizations opted to monitor identified wetlands prior to creating acquisition plans for the lands, while others developed action plans to acquire or protect the lands prior to long-term monitoring.

The policies and plans reviewed generally included guiding objectives for structure, which are summarized into the following themes: maintain healthy wetlands; maintain and/or improve wetlands that are important to important species (at risk or other); create opportunities for the sustainable use of wetlands; and create or improve opportunities for community engagement.

7.1 Maintain Healthy Wetlands

Most agencies developed strategies to protect habitat from conversion to other land uses and developed measures to monitor the habitat. This category also included objectives to restore degraded wetlands and maintaining the productivity of wetlands through monitoring programs.

7.1.1 Valuating Natural Assets

Natural assets, including wetlands, provide valuable goods and services to the surrounding community. Degradation of natural assets results in increased costs to municipalities and consequently results in the inability of municipalities to provide services to their citizens in a cost-effective manner (de Wit et al., 2009). Therefore, preservation of our natural assets and the ecosystem services they provide allows for economic and societal sustainability (de Wit et al., 2009).

The City of Nanaimo has begun identifying the value of some local assets to include in their financial decision making and asset management, allowing them to forecast and

budget for future expenses more accurately (Molnar et al., 2018). The City of Nanaimo used Buttertubs Marsh Conservation Area (BMCA) as their first natural asset to determine its value. Focusing on only two ecosystem services, detention of stormwater and reduction of flood flows into the nearby Millstone River; the study did not consider the many other ecosystem services that BMCA provides to the area, including recreation, carbon sequestration, and water quality (Molnar et al., 2018). To engineer a structure that conducts the same services that BMCA does would cost \$150 per cubic metre. Therefore, BMCA was valued at \$4,694,295, but could be valued considerably higher when considering climate change scenarios (Molnar et al., 2018). By valuating BMCA, the City of Nanaimo is now able to include these numbers in their current budgets, which will without a doubt aid in the preservation and maintenance of the area, as it costs considerably less than having to replicate or replace it in the future.



Figure 3. BMCA's two marshes and the trail that divides them (Molnar et al., 2018).

7.1.2 Land Acquisition

Obtaining property that hosts wetlands with the purpose of preservation or restoration is one of the most effective ways to deter development and maintain or restore healthy wetlands (Votteler & Muir, 2002). The acquisition of wetland parcels is a good investment, both economically and environmentally, and is one of the most prudent decisions that governments can make (Sandborn, Presnail, Gray & Hulse, 2015). By acquiring the land, the owner is able to ensure maintenance of the property and reduce any negative influences (United States Environmental Protection Agency (USEPA), 2005). In 2017, the City of Parksville was able to conserve a 35.9 hectare wetland by

acquired the property and designating it park land to only be used for recreational purposes and not development (Rardon, 2017).

It is not always possible for governments to purchase green space on their own, as it is a costly endeavour, especially considering the long-term costs of maintenance, as well. An alternative for governments is to collaborate with land conservancies, not-for-profit groups, and individuals in order to acquire wetland properties. For example, Ducks Unlimited worked with the Canadian government to acquire unclaimed land in Cape Breton, Nova Scotia, preserving it for waterfowl habitat (Weeks, 2016). In Canada, there is what's called the *Owner Unknown Program*, which refers to the acquisition of lands that have not been previously claimed (Weeks, 2016). In the event that a piece of land had not previously been claimed, it is possible for the provincial/territorial government to pay the property taxes and ultimately declare it Crown land (Weeks, 2016). In 2016, Ducks Unlimited identified 3,000 hectares of valuable wetland property on Cape Breton that had not been previously claimed; they worked with the provincial government to develop a plan for acquisition. The provincial government agreed to pay the property taxes for the land, while Ducks Unlimited agreed to aid in the management of the land with regards to waterfowl habitat (Weeks, 2016).

7.1.3 Wetland Management Plans

When considering wetland management it is important to consider the surrounding area with a broader lens, looking at the area with an ecosystem or watershed approach (USEPA, 2005). It is important the wetland's resources are preserved and used wisely. Alberts et al. (2008) identified that the following information is required to begin to effectively manage a wetland: "an understanding of the habitats and the species occurring; how these interact to form ecosystems; the natural processes that sustain them; and threats to these processes" (p. 7). Further, it is critical to grasp the impacts that humans are having on the area of interest and have had in the past; a holistic approach is the best approach (Alberts et al., 2008). It is important to note that management strategies are not a one-size-fits-all and that different management strategies should be developed for each ecosystem and/or watershed as they have different characteristics and will have varying requirements (Wetlands International, 1998).

It is typical that most local areas have multiple stakeholders or users; therefore, it is beneficial to include all parties in the planning process for wetland management, including but not limited to governments, local First Nations, and local organizations or individuals (Wetlands International, 1998). Management plans have been progressing in recent years and including more stakeholders involvement, especially with regards to local First Nations groups; there is less of a recognition of First Nations groups and more of an active involvement (Oviedo & Kenza Ali, 2018). Participatory and multi-stakeholder management are means of sharing the workload, increasing transparency with regards to decision-making, and allow for local knowledge sharing, allowing for all

parties to learn and educate a greater community regarding the wetland of interest and its beneficial characteristics (Wetlands International, 1998). By providing the local people with an opportunity to take part in the planning, sharing their knowledge, or by being involved in the monitoring associated with a wetland management plan, it can provide them with a sense of ownership, which would reduce the cost of implementing monitoring or maintenance, as the locals would take on some of that responsibility (Wetlands International, 1998).

Additionally, an important aspect of wetland management plan strategies to consider is long-term strategies for maintaining healthy wetlands and exit strategies for restoration projects. Wetland management plans consider long-term maintenance of wetlands, typically in the form of monitoring; this will allow for the group to have long-term data on the wetland and identify any shifts in typical trends. If there is a shift in the wetland from its norm, then the management team can promptly develop plans for restorative actions or modifications (Wetlands International, 1998). With regards to a restoration project, it is often occurring over a set period of time with some monitoring to determine the success of the project (Wetlands International, 1998). However, at some point it is not feasible to carry on high levels of monitoring, therefore, there should be appropriate exit strategies developed that would not result in any negative effects on the restored wetland (Wetlands International, 1998).

7.1.4 Regulatory Approaches

As previously discussed in Section 6.0 *Existing Policy*, there are many different regulatory approaches that can be considered, and are already in place in B.C. with regards to wetlands, including: licenses, permits, and certifications required prior to taking certain actions, zoning bylaws, and water quality standards.

Permits, licenses, and certifications are required in order to comply with regulations established at local, provincial, or federal levels (Government of British Columbia, n.d. c). The most typical license required in British Columbia with regards to wetlands is a water license, which ensures activities comply with the *Water Sustainability Act*; they are required when water flow is altered (i.e. diverted, storing surface or groundwater, etc.) (Government of British Columbia, n.d. c). Water licenses are commonly issued for “water use purposes supporting agriculture, commerce, domestic household requirements (surface water only), habitat conservation, industry, natural resources development, power production, water storage, and water supply” (Government of British Columbia, n.d. c, para 2).

Establishing zoning bylaws provides some protective ordinances for wetlands to reduce degradation and maintain healthy wetlands. Some zoning bylaws result in buffers around wetlands and riparian areas, which restricts potentially harmful development close by (USEPA, 2005). For example, the *Riparian Areas Protection Act* (2019) states “8(1)

Subject to subsection (2), the riparian assessment area for a stream consists of a 30m strip on either side of the stream, measured from the stream boundary” (part 3). Zoning bylaws are a valuable support used to protect wetlands and riparian areas on properties that are unattainable by governments or conservancies. Therefore, privately owned wetlands still receive protection and reduced degradation as a result (Ministry of Forests, Lands and Natural Resource Operations (FLNRO), 2016). Refer to the *Riparian Areas Protection Act* for all zoning bylaws pertaining to British Columbia’s wetlands and riparian areas.

Setting the water quality standards aids in the protection of a wetland’s inhabitants (biotic and abiotic) and maintains its hydrologic function (USEPA, 2005). Monitoring is required to ensure that the activities undertaken near or at a wetland are not resulting in point or non-point source pollution and there are no negative impacts on the wetland (FLNRO, 2016). The water quality standards for wetlands will vary depending on if a wetland naturally supports life under water (e.g. fish). The Ministry of Environment and Climate Change Strategy (MECCS) can set site-specific objectives, known as Water Quality Objectives, for a specific waterbody that secures the longevity of the site (MECCS, 2019). The Water Quality Objectives are based around uses and values associated with a waterbody including: “drinking water sources; aquatic life and its habitat; wildlife and its habitat; agriculture (livestock watering and irrigation); recreational use and aesthetics; and traditional, cultural, and social values” (MECCS, 2019, para 3). For a waterbody that has Water Quality Objectives, they must be considered when decisions may impact water quality. The Objectives are a way to “formalize water quality goals for important waterbodies in B.C., promote water sustainability and stewardship, and inform resource management decisions” (MECCS, 2019, para 5).

7.1.5 Monitoring

There are multiple types of monitoring, including baseline, trend, implementation, effectiveness, and compliance; the type chosen depends on the type of data that is of interest (WSP, 2009). Baseline monitoring is the starting point, the data can be used to determine the status of the wetland. Trend monitoring involves long-term monitoring; the data can be analyzed for trends, identifying how the variable changes overtime (i.e. increasing, decreasing, stable). Implementation monitoring is used when wanting to identify the extent that their best practices or restoration activities have been implemented; this is used when the activities undertaken were non-legally binding. Effectiveness monitoring is used to determine the extent that the goals of someone’s best practices or restoration activities success. Compliance monitoring is undertaken when a legally binding parameter is being measured. For example, it is used to determine if someone is complying with their permit (WSP, 2009). If the monitoring is not legally binding, than it can be undertaken by whomever is conducting the best practices work. Alternatively, if the monitoring is for legally binding purposes, the work needs to be

undertaken by a QEP (WSP, 2009). Monitoring activities can be very costly in the long-term, therefore, using local volunteers is a valuable resource. The volunteers benefit by learning about their local wetland and aid in the education of the community (Regional District of Nanaimo, 2019b).



Figure 4. Student Research Assistants mapping and monitoring a local wetland in the RDN (MABRRI, 2019).

7.2 Maintain and/or Improve Wetlands that are Important to Important Species

Identifying wetlands with endangered or key species optimizes the ability of agencies to promote the preservation of the area. Some agencies use important species to leverage that their habitat (i.e. wetlands) should be given equal conservation priority because it is integral to the health of the identified species. For example, a group in Wisconsin, USA, has been educating people that preservation of wetlands in their region aids in the conservation of monarch butterflies (*Danaus plexippus*), a charismatic species that grasps people's attention (Wisconsin Wetlands Association, 2018). Another group in Alberta is highlighting the use of wetlands by approximately one-third of the province's species at risk, which includes the whooping crane (*Grus americana*) and peregrine falcon (*Falco peregrinus*) (Wetlands Alberta, n.d.).

7.3 Create Opportunities for the Sustainable Use of Wetlands

Local governments, non-governmental organizations, and Indigenous groups used wetlands to create spaces for sustainable land use activities by protecting the habitat. This included opportunities for passive recreation or traditional use.

Wetlands, with their extensive flora and fauna, have become a hot spot for recreational activities. Numerous activities undertaken in wetlands include, bird watching, fishing, photography, hiking and hunting (Fresh Outlook Foundation (FOF), 2019; SCBD, 2015). With an ever-growing population, the preservation of green spaces is becoming more important (Sandborn et al., 2015).

In Nanaimo, BMCA has multiple opportunities for recreational activities. Bird banding, as well as bird watching, are popular activities in the BMCA. Vancouver Island University has a bird banding station on the property since 2013, where students and faculty conduct banding activities 30 to 60 days between April to October each year (Nature Nanaimo, 2019). Additionally, a maintained trail runs between the East and West marshes and has look outs and seating along it for users to enjoy the view (Friends of Buttertubs Marsh, 2017). There are many other wetlands in the RDN that have maintained trails adjacent to them; however, there is still a lot of potential for many of the existing wetlands to be accessed and sustainably used.

7.4 Create or Improve Opportunities for Community Engagement

Many local governments have developed interpretation and engagement opportunities for activities that encourage the sustainable use of wetlands or to interact with and inform the public.

In order to have the community engaged with wetland related activities, it is important that they have an understanding of wetlands and why they are important. Education and outreach is a very important way of informing the public about wetlands and why it is important we protect and monitor them (USEPA, 2005). Further, educating all types of land users, including urban dwellers and farmers, regarding the importance of wetlands and what ecosystems services they provide them directly allows for individuals to make the connections of why wetlands are important to them (USEPA, 2005).

Local citizens are valuable resources, they have intimate knowledge of their local region and can be trained to take part in all aspects of wetland preservation and restoration. By hosting workshops for local citizens to learn how to preserve or restore wetlands can result in them undertaking these actions on their own properties, as well as in the surrounding area (USEPA, 2005). Additionally, providing them with resources, such as landowner guides to assist them with the preservation or restoration of wetlands on their property has been found to be a valuable exercise (USEPA, 2005). Further, providing incentives to take action on their property would be a valuable exercise. The RDN's Team Watersmart has aided in funding and promoting many wetland monitoring and enhancement workshops in the local area, including the 2018 BC Wildlife Federation's WetlandKeepers Course (City of Nanaimo, 2018).

It was stated in section 7.1.3 *Wetland Management Plans*, that involving the community is important because they can provide local knowledge and assistance. It is also essential

to ensure there is a two-way information exchange, incorporating all of the local knowledge into the plan, but also providing the locals with scientific knowledge and findings from the work that is completed (Wetlands International, 1998).

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Appendix A: Wetland Ecosystem Services Summary

Wetlands have a wide variety of ecosystem services (not all are listed here). It should be noted that not every wetland provides all of these ecosystem services all of the time; different wetlands in different regions of the world are able to contribute different ecosystem services.

Ecosystem Service	Function/Role	Example of Ecosystem Service
Water Purification	Referred to as “kidneys of the landscape,” wetlands have a foundational role in the global and local water cycles: cleaning and purifying the water that passes through their system (Mitsch et al., 2015, p. 1). As water moves through the wetland, the suspended sediments, nutrients, and pollutants become trapped in the vegetation; the deposited materials generate a productive and nutrient-rich ecosystem. Wetlands are imperative in ensuring that groundwater, often used for daily, personal use by residents, does not reach toxic levels (Clarkson et al., 2013).	New York City anticipated the cost of water treatment plants would be US\$3 to \$8 billion. Alternatively, they received free filtration of their water by purchasing the wetlands surrounding their water reservoirs, for US\$1.5 billion. As a result, operating expenses are minimal and they are saving approximately US\$700 million a year (FOF, 2019).
Sediment & Nutrient Retention	Suspended sediments and nutrients move through wetlands in the water; they are deposited and generate a productive and nutrient-rich ecosystem. The greater amount of nutrients available, the greater the biodiversity. By capturing the nutrients in wetlands, there is a direct reduction in the risk of eutrophication in downstream aquatic environments. Further, since the sediments are trapped, it reduces the amount of sedimentation that occurs downstream, as well (Clarkson et al., 2013).	In 1979, dam and flood control structures were installed in the Waza-Logono floodplain in Cameroon, which seriously degraded the floodplains nutrient availability. With limited nutrients, the fishing and grazing activities were depleted and the once thriving area that sustained 10,000 people was no more. Mitigation activities were implemented in order to reverse this loss, costing more than US\$5 million (FOF, 2019).
Groundwater Recharge	As wetlands reduce the flow of water, it allows for the water to slowly percolate down into aquifers below the wetlands, recharging them; this is critical in regions that depend on groundwater for daily, personal use (Clarkson	Drilling a new well or deepen an existing one costs, on average, \$35.00 per foot in British Columbia. Therefore the typical cost of a new well is usually \$8,000 to \$15,000, but can be

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

	<p>et al., 2013). If a groundwater system is not replenished, it experiences declines in water, which ultimately has many expenses associated with it, including; increased energy costs to accommodate the required pumping necessary to retrieve the water; the cost of deepening the well, lowering the pump, or having to drill a replacement well (USGS, 2003).</p>	<p>more depending on the depth (Fraser Valley Well Drilling, 2019).</p>
<p>Biodiversity</p>	<p>Wetlands are incredibly diverse ecosystems, hosting diverse communities of invertebrates and vertebrates, including an extensive list of birds and over 100,000 known freshwater species (Secretariat of the Convention of Biological Diversity (SCBD), 2015). Wetlands are hubs for biodiversity and have been referred to as “nature’s supermarket”, and critical habitat for many migrating species (Mitsch et al., 2015, p. 1).</p>	<p>To construct a wetland, it costs approximately US\$30,000 to \$50,000 per acre; costs varied depending on the amount of earthwork, planting, and type of wetland that was being installed. In addition to the construction, these sites require annual maintenance, valued at 2% to 5% of the capital costs (Department of Environmental Protection, 2006).</p>
<p>Water Quantity Regulation & Storm Protection</p>	<p>Wetlands have the ability to stabilize water levels, especially during flood or drought conditions; they mitigate the significant impacts associated with each (Mitsch et al., 2015). When a flooding event is occurring, wetlands slow the speed of the water moving through the area, absorbing large quantities and reducing large surges of water escaping to waterways. Contrastingly, wetlands are able to retain the water they have collected throughout the wet season into the dry season, continuing to replenish groundwater systems and support their extensive biodiversity (Clarkson et al., 2013).</p>	<p>A study with regards to economic loss due to Hurricane Sandy in the Northeastern region of the U.S.A. was conducted. The storm resulted in approximately US\$46 billion in damages. The study found that these regions avoided US\$625 million in direct flood damages as a result of their existing wetlands regulating water quantity and movement (Naryan et al., 2017).</p>
<p>Carbon Sequestration</p>	<p>Wetlands, especially peatlands, are known to contribute to climate change mitigation by maintaining and sequestering large quantities</p>	<p>Wetlands are able to store between 81 and 216 metric tons of carbon per acre of land. It is projected that for every metric ton of</p>

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

	<p>of carbon. As wetlands are largely anoxic environments (below the surficial vegetation), there is little respiratory activity occurring; therefore, they are able to lock into the largest quantities of carbon of any terrestrial ecosystem. As much as 25% of the Earth’s organic soil carbon is contained in wetlands (Clarkson et al., 2013).</p>	<p>carbon that is sequestered, US\$2 of damage will be prevented (The Conservation Fund, n.d.). B.C. has approximately 13 million acres of wetlands; therefore, our wetlands are sequestering 1 to 2.8 trillion metric tons of carbon, which is equivalent to our province saving approximately US\$2 to \$5.6 trillion, globally.</p>
<p>Recreation & Ecotourism</p>	<p>Wetlands are significant tourist attractions and places for activity, providing a location for people to take part in hiking, birding, photography, hunting, and many other activities (SCBD, 2015). Ecotourism can be a large driver economically for many regions of the world.</p>	<p>Annually, there is \$1.5 billion spent in B.C. on activities in natural areas, including \$329 million on recreational fishing, \$302 million on viewing wildlife, and \$112 million on hunting (Wetland Stewardship Partnership (WSP), 2010).</p>
<p>Food & Product Source</p>	<p>Many of the world’s most critical crops are grown or gathered from wetlands, such as rice paddies and fish (Clarkson et al., 2013). Most commercially fished species spend some portion of their life cycle in coastal marshes and estuaries (SCBD, 2015). Further, there are many products that wetlands produce: fuelwood, water, dyes, tannins, and horticultural peat being a few examples (Mitsch et al., 2015).</p>	<p>Locally, in B.C., First Nations collect a variety of plants from wetlands for a range of purposes. For example, the shoots of common cattail (<i>Typha latifolia</i>) are edible, and the leaves are used to weave mats (Kuhnlein & Turner, 1991).</p>
<p>Local Temperature Reduction</p>	<p>Urban areas are subject to “heat island effects” meaning that the surface and air temperatures experienced in the urban area are hotter than those in their rural surroundings (Gartland, 2008). Having wetlands within the urban area aid in the reduction of the heat island effect by evapotranspiration and latent heat exchange. The water and vegetation in an urban wetland are able to absorb more of the heat than man-made structures are able to, ultimately</p>	<p>In Vancouver, paved surfaces can be as much as 27°C to 50°C warmer than the air. Large cities, even at night, can be 12°C warmer than the air surrounding them because the heat secured by the pavement is continuously being released into the night, causing the city to continue to warm (Climate Atlas of Canada, 2019).</p>

Wetlands Ecosystem Services, Policy & Best Practices: A Literature Review

	resulting in minimizing the peaks in heat during the hot, dry season (McLaughlin & Cohen, 2013).	
Cultural Values	Different wetlands, particularly bogs, have been able to preserve the remains of many historical First Nation sites. A combination of the anoxic and cold, water-logged soils that make up these environments contribute to the preservation of historical artifacts (Clarkson et al., 2013). Further, many groups maintain the importance of wetlands because of the number of culturally significant plants and animals that wetlands support, for both medicinal and substance purposes (Rescan Environmental Services Ltd., 2013).	There was evidence found that the Katzie First Nation, in B.C.'s Lower Mainland, were farming wetlands for <i>wapato</i> (<i>Sagittaria latifolia</i>), a semi-aquatic tuber, as early as 1800 BC. The archeological dig at the site in Pitt Meadows, B.C., unearthed large amounts of evidence, including more than 150 digging tools and 3,700 pieces of plant material (Omand, 2016).