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Best Management Practices

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Best Management Practices for Protecting Amphibians and Reptiles

B.C. Ministry of Environment Ecosystem Standards and Planning Biodiversity Branch

Relevant excerpts used only. The complete document can be found at:

<http://www.env.gov.bc.ca/wld/BMP/herptile/bmphertile.html>

Amphibians and reptiles have traditionally received less attention than other groups perceived to be more charismatic by the public, such as mammals and birds. However, they play important ecological roles as both predators and prey, and are an integral component of biodiversity. Their physiology and ecology makes them well suited to serve as indicators of environmental health of both aquatic and terrestrial ecosystems.

There has been growing concern regarding the status of amphibian species around the world due to impacts such as habitat loss and degradation, introduction of nonnative species, and epidemic disease (Stebbins and Cohen 1995, Semlitsch 2000). In some cases, species have declined dramatically over a short period, while others have slowly lost populations throughout their range over time.

In British Columbia, we have 19 native amphibian and 12 native reptile species, of which 47% and 58% are considered to be at risk (on the blue or red list) by the provincial Conservation Data Centre respectively. For those species that have been evaluated by the Committee on the Status of Endangered Species within Canada (COSEWIC), 71% of amphibians and 67% of reptiles are listed as special concern, threatened, or endangered. The threats to amphibian species considered at risk are varied, not always clear, and compounded by the fact that non-threatened and

declining species may be found occupying the same site. All identified threats to native amphibians and reptiles within British Columbia are in some way human-induced. Increased human population and land development will continue to threaten these groups.

There are many ways that amphibians and reptiles, and/or their habitats, can be protected, mainly through voluntary efforts. The Species At Risk Act (SARA) provides protection for individuals, residences, and critical habitats of those species listed as endangered or threatened. On federal lands, these protection requirements will come into effect once critical habitats have been identified and officially approved. Because the Act is relatively new, many uncertainties still exist on how it will be implemented and what the exact requirements and consequences will be.

In British Columbia, all wildlife, including amphibians and reptiles, are protected under the Wildlife Act. This means that, under the Act, a person commits an offence if they do any of the following without a license or permit:

- Imports or exports live wildlife, or the egg of a wildlife species into, or out of, British Columbia
- Attempts to capture wildlife
- Has live or dead wildlife (or parts thereof) in his or her personal possession
- Kills or wounds wildlife, other than prescribed wildlife, by accident or for the protection of life or property, and does not report promptly to an officer the killing or wounding and the location of the wildlife

Municipalities and regional districts have several tools for protecting land, including amphibian and reptile habitat:

Within the Local Government Act there are both broad tools (e.g., official community plans) and specific tools (e.g., tree protection bylaws) that could be used to address local environmental issues. In most cases, implementing stewardship at the local government level will involve stewardship clauses in several revised or new bylaws. The challenge is to create a set of coordinated local bylaws, to ensure that they integrate with provincial or federal regulations, and which together create a simple, effective and reinforcing environmental protection program.” (Lanarc Consulting Ltd. 1997)

These tools include Development Permit Areas (DPAs), Regional District Planning Services, Advisory Planning Commission, zoning, landscaping, Flood Plain Designation, Tree Cutting Permit Areas, Development Cost Charges, and Conservation or Restrictive Covenants (Gawronski 1999).

Compatibility of Amphibians and Reptiles with Urban Environments

As with most taxonomic groups, the compatibility of amphibians and reptiles with urban development is species-specific and highly variable. A few species are largely compatible, several others may coexist with these developments if special provisions are made, and some are incompatible because they require large, relatively undisturbed natural areas. Amphibians most closely associated with forest cover, especially older, more mature forest, or that require specific habitat features such as ephemeral wetlands or intact upland areas are less likely to be found in urban environments, unless large parks or reserves are preserved. Numbers of some species are greatly reduced in urban areas, but the reasons remain unclear. For example, anecdotal evidence suggests that Western Toad (*Bufo boreas*) populations have declined in the Lower Mainland and on southeastern Vancouver Island (Wind and Dupuis 2002). However, lack of information on the distribution of the species and possible reasons for the decline makes it impossible to pinpoint the exact mechanisms and whether urbanization is a conclusive factor. Situations such as this

emphasize the need for inventory and monitoring, as well as studies into the basic habitat requirements of amphibians and reptiles.

Several species of amphibians and reptiles appear to be amenable to some level of disturbance, as long as critical habitats have been identified and adequately protected. Species with small home ranges and highly aquatic species may be more readily maintained in natural areas within an urban setting. For example, some terrestrial salamanders move very little throughout their lifetime, and highly aquatic species rarely venture far from water, so that reserves and riparian buffers should meet the majority of their habitat needs. For reptiles, buffers around critical habitats such as dens, rock outcrops, and talus will help to maintain viable populations within urban areas. For both groups, maintaining connectivity among populations is critical.

Opportunities for Protection and Management

There are numerous ways that local governments can take responsibility for protecting amphibians and reptiles:

- An important first step is the mapping of critical habitats for amphibians and reptiles to identify these areas before development begins so that they can be incorporated into management plans. This can be accomplished by contacting regional amphibian and reptile experts, reviewing wildlife studies that have been conducted in the local area, and via the implementation of a volunteer-based inventory and monitoring program; local naturalist groups, and non-profit organizations and stewardship groups can serve as a valuable resource to begin such a program.
- Promote the use of the BMPs recommended in this document as evidence that other jurisdictions have recognized the importance of managing habitat for amphibians and reptiles.
- Promote the concept that amphibians can serve as indicators of environmental health. This can be accomplished via the implementation of a regional inventory and monitoring program that operates in a variety of areas to track populations and species richness across varying degrees and types of developments.
- Use the support for local monitoring programs as evidence of the public's knowledge and interest regarding amphibians and reptiles. The loss of frog populations, especially those that produce audible breeding calls, will not go unnoticed by the general public, and will not reflect well on those responsible for development. The information collected through inventories and monitoring programs could be used as evidence of the use, importance, and knowledge of

amphibian and reptile areas that require some form of protection, as well as public support.

- Demonstrate that it can be fairly easy to protect basic habitat requirements for amphibians and reptiles, which in turn will protect numerous other species as a result (such as rare aquatic plants and dragonflies). The use of monitoring programs will demonstrate the array of species that can be preserved within urban areas. Make the results of inventory and monitoring program readily available to the general public.

Best Management Practices for Amphibians and Reptiles: Summary

British Columbia has a rich fauna of amphibians (frogs, toads, and salamanders) and reptiles (turtles, lizards, and snakes), including several species that are on the provincial red- and blue-lists of species at risk; some are nationally endangered or threatened. Because of widespread population declines over the past decades, there is growing public concern for their well being. Amphibians and reptiles play important roles in ecosystems as both prey and predators. Many are beneficial to people as consumers of pest insects, slugs, or rodents. Because of their semi-permeable skin and exposed eggs, amphibians are particularly sensitive to environmental changes and contamination of their habitats on land and in water. The presence of thriving amphibian populations is an indication of a healthy environment. There are many ways local governments, land-use planners, and developers can incorporate measures that benefit amphibians and reptiles into their zoning, management, or development plans (see summary below).

All species of amphibians and reptiles:

- Try to locate developments and roads away from key habitats for amphibians and reptiles, such as wetlands, streams, and nesting and denning sites.
- Maintain buffers of undisturbed native vegetation around and adjacent to key amphibian and reptile habitats and discourage human access to these areas.
- Provide suitable landscape linkages to allow movements of animals between important seasonal habitats; riparian management areas and greenways can connect habitats.
- Minimize road kill of animals migrating between seasonal habitats by locating roads and infrastructure away from these areas; consider special road-crossing structures where this is unavoidable.

- Control the spread of nonnative animals and plants; introduced Bullfrogs and fish compete with and prey on native amphibians; weedy exotic plants can overtake native vegetation and choke wetlands.
- Encourage residents to take an interest in protecting these species by providing interpretive materials such as signs and brochures.

Pond-breeding amphibians:

- Preserve all wetlands, ponds, pools, and streams – however small or ephemeral; these small areas can be very important for amphibians.
- Protect shallow water areas and their vegetation from trampling and other disturbance; these areas serve as breeding habitat and cover for many amphibians.
- Avoid altering natural patterns of flooding and drying of wetlands; temporary wetlands often have few predators and are important for amphibians.
- Maintain sufficient terrestrial habitat or access to terrestrial habitat for amphibians to complete all life history phases.

Terrestrial salamanders (Plethodontid salamanders):

- For coastal species, preserve moist, wooded areas.
- Avoid removing downed logs and bark, especially large diameter pieces; downed wood in various stages of decay provides shelter and egg-laying sites.

Painted Turtle:

- Protect nesting habitats adjacent to wetlands from disturbance and human access; typically these sites are located on dry and light soils with little vegetative cover on a southern slope within 150 m from water.

Lizards and Garter snakes:

- Protect south-facing, rocky slopes, used as basking, hibernation, or nursery sites.

- Retain talus (layers of weathered rock, often at the base of slopes), rock outcrops with fissures, and coarse woody debris, which provide shelter for reptiles.
- Provide access to wetland foraging areas for garter snakes.

Habitat protection

After surveys and assessment of habitat quality have been conducted, it is important to protect the identified habitat components and movement corridors to maintain the viability of populations of amphibians and reptiles present. These practices include protecting critical habitat features and providing sufficient space, connectivity, and habitat diversity needed for all life-history stages. In addition, mitigation measures are required to maintain the quality of the habitat.

Protect critical habitats and special areas:

Special areas for amphibians and reptiles need complete protection and should be set aside. A protective buffer adjacent to these areas and connectivity to undisturbed habitat need to be maintained. Some special sites, such as breeding ponds of toads and frogs, may be small in area but might contain a significant proportion of the local or regional population of one or more species. Their relatively small size makes them amenable to protection as long as sufficient space for movements to other required habitats, such as foraging areas, is retained. Nesting and hibernation sites often contain unique environmental features, and individuals may have to travel long distances to such sites.

The following critical habitats need to be identified and protected:

- Nesting sites of freshwater turtles. One native species, the Painted Turtle, occurs in British Columbia. Its egg-laying and nursery habitats are specific with respect to exposure (southern aspect), substrate type (dry and light soils with little vegetation cover), and distance from aquatic habitat (within 150 m).
- Snake hibernacula, denning sites, and foraging areas. The Common Garter Snake (*Thamnophis sirtalis*), which has a wide distribution within the province, also hibernates communally in some areas, particularly in northern environments.
- Breeding ponds and streams used by multiple species of amphibians
- Mass migration corridors of toads, some frogs and salamanders

- Protect all necessary habitat components in sufficient quantities:

Managers should strive to maintain a diversity of aquatic and terrestrial habitats and provide suitable landscape linkages to allow movements of animals between important seasonal habitats. Because they are ectothermic (deriving their body temperature from the environment rather through physiological means as do mammals and birds), amphibians and reptiles are strongly influenced by their environment, and their survival is dependent on the array of habitats available to them. Reptiles regulate their body temperature by selecting warm microhabitats if they are cold and cooler areas when they are hot. Secure basking and resting areas are a required part of their daily range. Snakes, for example go to basking areas or warm surfaces after a meal to facilitate digestion. Many species need access to foraging areas that might be separate from basking or refuge areas. Amphibians have moist skin and require ready access to water or moist microhabitats. With the exception of one group of forest salamanders that are completely terrestrial, all species in British Columbia require water for breeding. Many amphibians become inactive during periods of dry weather and need moist refuges to survive.

Most amphibians and some reptiles require both aquatic and terrestrial habitats for successful completion of their life-cycles, and this results in additional management challenges. While the importance of protecting aquatic breeding habitats of amphibians has long been recognized, terrestrial habitats that are equally essential for their different life-history have often been neglected. Similarly, for reptiles, the protection of critical habitats alone, such as snake dens and turtle nesting areas, is insufficient to maintain viable populations if the habitats for foraging and other essential needs are not met.

If viable populations are to be maintained, the following habitat components need to be protected :

- Wetland and upland habitats for amphibians and reptiles – Although only a few amphibians (Plethodontid salamanders) are completely terrestrial, almost all require terrestrial habitats in addition to standing or flowing water.
- Diversity of habitats, including both temporary and permanent wetlands and adjacent upland habitats. Temporary wetlands that have an annual pattern of drying and filling provide a valuable and diminishing resource for amphibians and reptiles. Many species of amphibians rely on temporary wetlands that are free of large aquatic predators and contain abundant food.
- Wetlands, ponds, pools, and streams – however small – that are used by breeding amphibians.
- Habitat features important for amphibians and reptiles, such as coarse woody debris, rock outcrops, talus, and appropriate substrates for burrowing.

Maintain habitat quality; provide undisturbed buffer zones adjacent to important habitats:

Amphibians and reptiles need undisturbed natural vegetation adjacent to wetland areas for foraging and to complete life-history stages. Buffer zones also serve to protect the water quality of wetlands by filtering out pollutants and sediments. The recommended widths of buffer zones as determined by best available science vary considerably according to the species present. A buffer zone of at least 30 m (the wider the better) on each side of a stream or along a wetland might benefit many species. For very small wetlands, a 3:1 ratio of undisturbed upland habitat to water is recommended. For example, a pond 1/3 ha in size should have a surrounding buffer area of 1 ha. The size of the buffer zone will depend on the size of the development and the availability of adjacent, alternative habitats, such as green spaces and parks.

Undisturbed native vegetation left adjacent to important terrestrial habitats for amphibians and reptiles helps protect these sites; such sites include snake denning areas, talus slopes, turtle nesting sites, and foraging areas.

Allow natural processes in the area to continue:

- Maintain natural hydrology of wetlands and streams, so that these habitats continue to provide suitable conditions for semi-aquatic species over the long term.
- Retain natural vegetation whenever possible; the maintenance of natural ecosystem processes will promote high species diversity of amphibians and reptiles.
- In upland habitats, avoid compaction and disturbance of the ground including soil, litter layer, and coarse woody debris; avoid removing natural vegetation and mowing grassy areas adjacent to wetlands.
- Changing the frequency or intensity of natural disturbance regimes has well-known effects on ecosystems and might affect amphibians and reptiles.
- Maintain original connectivity of habitats and populations:
- Avoid fragmentation of habitats; where habitats are already fragmented, provide habitat continuity that allows for movements of animals. Ensure that

connectivity is maintained by setting aside undisturbed habitat for travel routes to these areas. Maintain a buffer zone of undisturbed vegetation around streams, so that a travel corridor is maintained.

- Movement corridors must be of sufficient width and contain habitat attributes that are attractive to amphibians and reptiles.
- Protection of undisturbed riparian areas such as along meandering creeks is an excellent option for maintaining connectivity of populations and habitats; however, it is crucial that no gaps of unsuitable habitat exist.

Lower Mainland

The Lower Mainland region covers the western slopes of the Coast Mountains from the United States border to north of Bute Inlet and includes a variety of habitats ranging from rock and ice to highly productive temperate rainforest at lower elevations. Western hemlock, western redcedar, and Douglas-fir are dominant tree-species in coastal rainforests of this region. In the south, the Fraser River forms an extensive flat-bottomed valley and delta, which contains most of the human population of the region. Bogs and marshes were once abundant on this floodplain, but most wetlands have been diked and drained since the 1940s. Much of the valley bottom has been converted into farmland and urban developments (Cannings and Cannings 1996).

Composition of amphibian and reptile faunas of this region:

- 11 native and 2 introduced species of amphibians
- 6 native and 1 introduced species of reptiles (2 additional species of native reptiles are extirpated from this region)
- Red-listed species: Oregon Spotted Frog, Coastal Giant Salamander, Western Pond Turtle (extirpated), Gopher Snake (coastal populations; extirpated)
- Blue-listed species: Coastal Tailed Frog, Red-legged Frog, Painted Turtle
- Species unique to Region 2: Oregon Spotted Frog, Coastal Giant Salamander

Main threats to amphibians and reptiles in urban/rural areas:

- Habitat loss and alteration
- Draining and filling of wetlands
- Pollution from agricultural areas

- Introduction of nonnative species

Almost 50% of the population of British Columbia lives in the Lower Fraser Valley. Vancouver is the fastest growing city in Canada (City of Vancouver 2003). Consequently, natural areas on the Lower Mainland have been greatly modified and fragmented. Habitat loss and alteration associated with urban expansion onto mountain- and hillsides are a growing threat to forest dwelling species. Introduced Bullfrogs occur in many wetlands and pose a threat to native amphibians.

Habitat protection and restoration practices for red- and blue-listed species:

Red-legged Frog is widespread in forested habitats within this region but may be declining. The following BMPs are applicable within the range of this species:

- Protect wetlands and streams
- Provide connectivity between terrestrial forest habitats and aquatic breeding sites

Widespread, compatible species:

The following species are relatively compatible with urban developments and should respond favourably to habitat protection and restoration efforts:

- Pacific Treefrog
- Northwestern Garter Snake, Common Garter Snake, Western
- Terrestrial Garter Snake, Northern Alligator Lizard

Additional issues:

Western Toad and Rough-skinned Newt are vulnerable to road mortality during seasonal migrations.

- Take actions to reduce the spread of Bullfrogs, nonnative fish, and other introduced species.
- Undisturbed riparian and forested habitats are becoming highly fragmented in the Fraser Valley. Use BMPs that address landscape connectivity among fragmented wetlands, riparian zones along creeks, and patches of moist forested habitat.

Poor water quality, channelization of streams, and alteration of water regimes have a major impact on wetland habitats. Use BMPs that prevent contamination of wetlands and maintain appropriate water fluctuations

Best Management Practices of Raptors

B.C. Ministry of Environment Ecosystem Standards and Planning Biodiversity Branch

Relevant excerpts used only. The complete document can be found at:
http://www.env.gov.bc.ca/wld/documents/bmp/raptor_bmp_final.pdf

Many species of raptors (birds of prey) have been adversely affected by urban and rural land development in British Columbia (Campbell et al 1990). However, raptors can often coexist with people in human-modified landscapes if certain practices are adopted. This Best Management Practices (BMP) document was produced to assist local government staff, the development community, and landowners with the conservation of raptors and their habitats in urban and rural areas of the province.

Raptors are valuable components of terrestrial ecosystems and occur in nearly all terrestrial habitats of British Columbia. Historically, people have held strong, often polarized views about raptors, resulting in actions ranging from reverence to persecution. Currently, raptors are recognized as an integral part of ecosystems in much of the world, including British Columbia, and are legally protected. The cumulative effects of small-scale human activities, ranging from simple disturbance to cutting down a nest tree, can reduce the abundance and number of species of raptors in an area. In many cases, critical habitat features required by raptors can be protected or restored, so that opportunities to maintain or enhance raptor biodiversity in urban and rural environments can be realized.

Why Raptors are Important

Raptors play important roles in ecosystems and are valued by society in several ways:

Aesthetic Values—A species' natural beauty and artistic appreciation. Raptors have many attributes admired by the public including a striking, noble appearance, remarkable flying ability and keen senses. The aesthetic values of raptors are often portrayed in the work of artists and photographers.

Spiritual Values—A species' relation with and role in human culture, spanning scales ranging from an individual to an entire society. Bald Eagles, Golden Eagles and other raptors play a significant spiritual role in many Native American societies. Throughout history, raptors have been an emblem of strength, courage and freedom, and are frequently the namesake of sports teams, automobiles, and aircraft. By viewing wild raptors in urban and rural areas, people are able to maintain an important psychological connection with nature.

Recreational Values—Qualities stemming from recreational pursuits associated with the species. Economic and non-economic aspects are included. Examples of recreational values of raptors include bird-watching and falconry. Raptors are

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renowned for their ability to attract bird-watchers (e.g., the annual gathering of Bald Eagles near Squamish, British Columbia; Link, and concentration of migrating raptors at Beechy Head on the southern tip of Vancouver Island).

Educational and Scientific Values—The study of raptors allows a better understanding of the world around us. This understanding may simply add to our knowledge base or be used to improve the quality of human life and ecological conditions. Because of their top position in the food-chain, raptors serve as barometers of environmental change and overall ecosystem health. They typically require large areas and healthy prey populations for survival. As such, measures that conserve raptors can provide an umbrella of protection for many other plant and animal species. The quality of raptor health is a measure of environmental health. For example, environmental contamination with DDT resulted in adverse effects on many species of raptors. By discontinuing the use of that pesticide to conserve raptors (and other species), environmental conditions for humans and other animals have improved.

Ecological Values—The roles that species play in the ecosystems they occupy. Raptors consume a wide variety of prey including small mammals, birds, reptiles, amphibians, fish, and insects. Hence, they play a role in regulating prey populations and in nutrient cycling. Raptors are also important components of biological diversity. The variation among different species and the genetic variation within individual species of raptors (i.e., the “gene pool”) contribute to the biodiversity of a region. Because research into raptors is ongoing, the full range of ecological values will not likely be known

Economic Values—How raptors affect the lives and livelihoods of people. By helping to control prey populations, raptors can directly benefit humans by reducing pest species (many of which are non-native) such as rats, mice, rabbits, starlings, house sparrows, pigeons, and grasshoppers. Eagles and Vultures help reduce the spread of disease by cleaning up dead and rotting animal carcasses. Travelling birdwatchers spend considerable amounts of money on food, drink, lodging, gasoline and other local services. Raptors are highly sought by birders and communities with large raptor populations can benefit economically. The Bald Eagles of Brackendale near Squamish are a significant source of tourist revenue for the surrounding community (Link). The presence of raptor habitat (wooded areas, wetlands, old fields) can add to the economic value (marketability) of a property. Falconers use raptors to scare other birds from airports to reduce the risk of birdstrikes and aircraft damage, reduce crop damage, disperse pest species at landfills, and reduce pollution of urban parks by keeping geese away from sports fields and swimming beaches.

The Role of Local Government in Raptor Conservation

Current legislation at the provincial level protects birds, their nests and eggs, but provides little, if any, protection for their habitats—especially on private, municipal 14

and regional lands. So, while the Province retains jurisdiction over raptors in British Columbia, local (municipal and regional) governments are often in a better position to serve as stewards of raptor habitat in urban and rural areas. Through the *Local Government Act and Community Charter*, local governments have the authority to regulate development within their jurisdiction. The role of local governments in the maintenance of raptor populations is vital because much of British Columbia's best land for development also contains critical raptor habitat used for breeding, migrating/staging and wintering. This overlap typically occurs in the lowlands and valley bottoms, which contain productive raptor habitats. Such land is relatively rare in British Columbia; a province dominated by high, rugged mountains with harsh climates, and limited food supply for raptors.

The role of local governments and the development community in protecting raptors is expected to expand in the future. For example, the *Community Charter* empowers municipalities with the ability to take a leading role in wildlife stewardship. Local governments need to address the habitat needs of raptors and other wildlife when regulating development. The responsibility for stewardship is shared among several parties, including the Provincial Government.

Key Issues of Concern and Conservation Opportunities

A major threat to raptor habitat in British Columbia is the large-scale conversion of agricultural lands and natural areas to land uses that typically involve impermeable surfaces (i.e., pavement and asphalt) and buildings. The Lower Fraser Valley and Delta traditionally supported some of the highest densities of wintering raptors in Canada (Butler and Campbell 1987), but populations and have been greatly reduced as a result of human activities over the past century. The future of raptor populations in British Columbia depends on action taken now.

The main threats facing raptors in the Lower Mainland are urbanization, agriculture, and forestry. Old-growth forests have been depleted, especially at low to moderate elevations, and coastal habitats have been greatly modified. On the Lower Mainland, the Fraser Delta is a nationally significant wintering area for many species of birds, including raptors. However, habitats in this area have been greatly modified and continue to be threatened.

Raptor species most affected by these threats include the Spotted Owl, Northern Goshawk (laingi subspecies along the along the BC Coast), Peregrine Falcon, Merlin, Bald Eagle, and Western Screech owl. The species that are relatively compatible with human activity and are most likely to benefit from BMPs in urban and rural environments include the Bald Eagle, Osprey, Cooper's Hawk, Sharp-shinned Hawk, Red-tailed Hawk, Rough-legged Hawk, Merlin, Great Horned Owl, Barred Owl, Barn 15

Owl, and several small, cavity-nesting owls (Western Screech owl, Northern Saw-whet owl, and Northern Pygmy-owl).

Legal Requirements

At the provincial level, raptors and most other birds are protected in British Columbia under Section 34 of the *Wildlife Act*. Under this Section, a person commits an offence, if he/she possesses, takes, injures, molests or destroys a bird or its egg, or a nest that is occupied by a bird or its egg. Subsection 34 (b) provides protection year-round to the nests of the Bald Eagle, Golden Eagle, Peregrine Falcon, Gyrfalcon, Osprey and Burrowing Owl, whether the nests are active or not. However, the habitat immediately surrounding the nest site (other than the nest tree), or habitats needed for foraging, roosting, or wintering, may not be protected unless they occur in a protected area such as a park. If it can be shown that an activity or development will "molest, injure or destroy" a nest site as defined by the *Wildlife Act*, protective buffers may need to be established to reduce disturbance of the nest, although the degree of protection required is not specified by the Act. This uncertainty and lack of adequate habitat protection has considerable implications for raptor conservation. The *Wildlife Act* also gives the provincial government authority to protect habitat through the creation of Wildlife Management Areas, designation of Critical Wildlife Areas (for threatened and endangered species), and creation of regulations governing use of land and wildlife. However, these provisions have limited applicability to urban and rural environments where the amount of provincial Crown land is limited.

At the Federal level, raptor species officially designated as "at risk" are also protected under the new *Species at Risk Act*. Federal protection for raptors at risk under Schedule 1 of SARA, including their residences and critical habitats, is mandatory on federally owned land (such as federal forestry lands, Indian Reserves; airport lands owned by Transport Canada; and military lands owned by the Department of National Defence). The goal of the *Species at Risk Act* is to prevent endangered or threatened wildlife from becoming extinct or lost from the wild, and to help in the recovery of such species. Those species listed as being of "special concern" will be managed so as to prevent them from becoming endangered or threatened. The role of the federal government in raptor conservation may expand beyond federal Crown lands, if safety net legislation is imposed. Under this legislation, the federal cabinet may, at the recommendation of the Minister of Environment, order that protective measures be applied to provincial lands as well as federal lands.

Due to the lack of protection of raptor habitats in urban and rural environments afforded by legislation at the provincial and federal levels, local governments and the development community have a vital role to play in the protection of raptor habitat and shared wildlife stewardship on private and municipal lands. As discussed in Section 4.3, the *Local Government Act* and *Community Charter* empowers local governments to expand their role in conservation of raptors and other wildlife. The responsibility for stewardship will be shared among several parties, including the provincial government.

Best Management Practices

BMPs are measures that help to achieve the goal of maintaining raptors and their habitats in urban and rural environments. The BMPs in this document (summarized in Table 1) are based on ecological needs and behavioural traits of raptors and are generally applicable to urban and rural landscapes found in all regions of the Province. However, the selection of BMPs may differ according to local knowledge of the behaviour, life history, habitat use patterns and conservation needs in each region of the province. For more specific information on how to proceed with raptor protection measures in your area it may be beneficial to seek advice from professional biologists and local naturalist/conservation groups familiar with raptor ecology.

An extensive literature search indicated that while there is an abundance of recommended approaches to raptor management and conservation (particularly in regard to industrial forestry and agricultural practices), formal documents presenting a range of BMPs for raptors in urban and rural environments are lacking. In this regard, British Columbia is leading the way.

A summary of the species of raptors present and the timing of breeding in each MOE Region of British Columbia (see Link for map of Regions) is presented in Table 2. BMPs should focus on, but not be limited to, species that breed in each region. Habitats that provide foraging and resting areas for over-wintering or migrating raptors are also important to maintaining raptor biodiversity of an area. It is important that protective measures account for species differences in breeding chronology. For example, the Bald Eagle and most owls nest very early in the spring, whereas others (such as the Osprey and Cooper's Hawk) nest later in the season. Measures to reduce disturbance of nest sites should be implemented over the entire breeding season, not just when young are in the nest. During the early stages of nest initiation, for example, raptors are particularly sensitive to disturbance and may seek alternative nest sites or delay nesting, if harassed. A relatively large number of nest records exist for raptors in the province (Table 2, based on *Birds of B.C.*, Vol. 2; Campbell et al. 1990). A low number of nest records can reflect either scarcity of a particular species (such as Spotted Owl) or the difficulty in locating nests because of their cryptic nature or occurrence in remote areas (such as Boreal Owl and Sharp-

shinned Hawk). Further information on the life history and distribution of raptors is provided in Section 10.

The provincial conservation status of different species of raptors and their ability to coexist with humans in urban and rural environments are summarized in Table 3 (see Section 10 for more details on compatibility of raptors). The compatibility rankings are estimates meant to show the wide ranges in tolerances of human developments among species. Generally, the least tolerant species are those with strict habitat requirements or that require large areas of undisturbed land. Birds that prefer old-growth or mature forests (Spotted Owl and Northern Goshawk) or remote mountainous areas (Golden Eagle) are good examples. BMPs are most likely to be successful for those species with a high compatibility with human activity. Where possible, BMPs should also try to address the requirements of less tolerant species or species that are at risk. However, such efforts should be planned with particular care and should not compound the problems faced by these species by attracting them to unsuitable habitats where their survival or productivity are compromised. Whenever protective measures are designed for species that are officially listed to be at risk, additional advice and information should be obtained from a professional biologist.

The BMPs and other parts of this document strive to address the following principles of raptor conservation in urban and rural areas:

1. Where possible, retain existing, natural habitats suitable for raptors

The best way to conserve raptors in urban and rural environments facing possible developments is to ensure that an adequate amount of suitable habitat is left undisturbed.

2. Strive to retain, restore, or enhance key habitat features for raptors, so that no net loss of habitat occurs

These features consist of nesting, roosting, and other sites that are essential for raptors. Provincial and federal laws provide legal protection for nests of some species of raptors, most unoccupied nests are not protected when not in use or outside the nesting season. Perches and roosts are not afforded legal protection on private land. In cases where known habitat features cannot be retained, **mitigation** is recommended through habitat restoration or enhancement. The best option is always to retain existing, natural features.

3. Use caution when attempting to restore or enhance raptor habitats.

Some methods for habitat enhancement are simple, such as providing artificial nest sites. Others are more complex and involve restoring key habitat features required to fulfil various life history functions and ecological needs of raptors. Caution must be

used to prevent attracting raptors to otherwise unsuitable areas where survival and productivity may be reduced.

4. Avoid disturbing raptors at nesting, roosting, and feeding sites.

In some cases, it is possible to establish undisturbed buffers around active raptor nests, known roosts, and feeding sites, such as salmon-spawning areas. Specific minimum sizes of buffers are suggested in this document, but larger buffers may be required depending on the conditions at each site.

5. Be able to demonstrate that activities comply with Provincial laws (see Section 6 and 14.1).

In British Columbia, the active nests of all raptors are legally protected; inactive nests of the Bald Eagle, Golden Eagle, Peregrine Falcon, Gyrfalcon, Osprey or Burrowing Owl are also similarly protected. The destruction of any aforementioned nest (or nest tree) requires authorization from the Province. All developments must exercise due-diligence in attempting to identify nests and in avoiding or mitigating impacts on them.

6. Try to ensure that decisions regarding urban and rural land developments are credible and are based on adequate information on any raptor habitats that might be affected

Shared stewardship of wildlife implies that expert advice and information can be sought from a variety of sources, including naturalist groups, and local wildlife experts. Landowners may also wish to seek advice from professional biologists familiar with raptor ecology.

Standards and Best Management Practices for Instream Works

B.C. Ministry of Environment Ecosystem Standards and Planning Biodiversity Branch

Relevant excerpts used only. The complete document can be found at:

<http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>

Streams

Streams are complex ecosystems supporting a range of aquatic habitats and species. Streams often support rare and endangered species and may or may not support fish habitat. A "stream" as defined in the Water Act is "a natural watercourse or source of water supply, whether usually containing water or not, ground water, and a lake, river, creek, spring, ravine, swamp and gulch."

Consistent with the definition in the Act and in support of the federal Fisheries Act, channelized streams and some constructed ditches, such as those in floodplain areas, which provide fish habitat would also be considered streams.

Fish and Wildlife Habitats

Any proposed works in or about a stream must protect fish and wildlife habitat. The Water Act Regulation defines "habitat" as "the areas in and about a stream, including (a) the quantity and quality of water on which fish or wildlife depend directly or indirectly in order to carry out their life processes, and (b) spawning grounds and the nursery, rearing, food supply, and migration areas.

Not only the watercourse itself but also the vegetated streamside areas that provide nutrients and shade to the stream are considered fish and wildlife habitat.

Fish habitat includes watercourses, streams, ditches, ponds and wetlands that provide water, food, or nutrients into a fish-bearing stream even if they do not contain fish or if they only have temporary or seasonal flows.

The Water Act also applies to those streams that may have no fish habitat, yet still meet the definition of a stream. These streams are important for the complex ecosystem functions they provide, which could include the support of amphibians and rare and endangered species.

Works In or About a Stream

Works in or about a stream are defined under Section 9 of the Water Act as all works proposed in or about a stream, ravine or active floodplain of a stream or its riparian or streamside area. If your works are listed here, Part 7 of the Water Act Regulation authorizes you to construct your works and to complete other specified ²⁰

changes in and about a stream to an acceptable standard following the submission of a Notification to MOE.

Such works may include (see description at the end of this document):

- Stream Crossings
- Stream Channel Maintenance
- Urban Stormwater Management
- Beaver and Beaver Dam Management
- Miscellaneous Works
- Other Types of Instream Works Requiring an Approval Application Under the Water Act

Potential Impacts of Instream Works

Healthy aquatic ecosystems are dynamic – they are always changing. Instream work carries a high risk of affecting water quality and quantity, fish and wildlife species, and riparian and aquatic habitats by altering streams and streamside (i.e., riparian) areas (Figure 1). All instream works are potentially very intrusive to aquatic and riparian ecosystems. Such works can disrupt the continuity of riparian corridors, increase flows and stream power, cause temporary or permanent loss or alteration of aquatic habitats, and result in temporary or permanent loss of riparian vegetation.

With the potential for such significant impacts on fish and wildlife populations and habitats, instream works should be avoided.

Biological Impacts: Impacts to Riparian vegetation and Fish & Wildlife Populations

Riparian vegetation

Riparian vegetation is fundamental to the maintenance of healthy aquatic ecosystems. Vegetated riparian areas play critical roles in:

- providing woody debris that contributes to channel complexity and maintains microclimate conditions;
- buffering the effects on water quality of flow changes, such as increases in stream power and erosion, and changes in water temperature;
- buffering streams from sedimentation and pollution in surface runoff;
- contributing food and nutrients in the form of insects and organic litter fall;
- stabilizing soils through root matrices; and
- providing shade and cover to control temperature and manage predation.

Riparian areas also maintain critical aquatic and terrestrial wildlife habitats adjacent to the stream. Many of British Columbia's animal species use riparian zones. These

habitats provide higher complexity and structural diversity of vegetation and wildlife than any found in upland areas.

Fish and Wildlife Migration

An additional impact of instream works on aquatic habitat is the potential to form a total or partial barrier to fish or wildlife migration or movement. Instream structures or changes to the stream channel may alter flow velocities or depths. Fish migration occurs in response to a variety of needs including, but not limited to spawning, rearing, feeding, escaping too high or too low stream flow conditions, escaping poor quality or polluted waters, and escaping predators. Section 20(1) of the federal *Fisheries Act* requires fish passage to be maintained.

As well as providing valuable fish habitat, non-fragmented riparian areas provide critical migratory habitats for terrestrial wildlife, amphibians, and birds. Migratory bird abundance and diversity are generally greater in riparian areas, and small mammal communities tend to be more diverse along streams than other habitat types. Large mammals, such as deer and bears, use riparian areas as migratory corridors to search for food and mates, and to travel to breeding areas or between summer and winter ranges. Interruption of these migration corridors reduces habitat function and value and may cause greater human-wildlife conflict and reduced wildlife survival.

Most amphibians and some reptiles migrate to specialized aquatic areas to reproduce and many spend much of their lives in riparian areas. Shoreline works in particular can have significant impacts on the habitats and migration routes used by these species. Lakeshore stabilization works can create vertical barriers to amphibian and reptile movement, and may disturb the foreshore habitats required for breeding.

Species at risk

Many of British Columbia's species at risk are supported by riparian and aquatic habitats. These include, but are not limited to:

- Painted Turtle (lakeshore habitat)
- Pacific Water Shrew (riparian forest habitat)
- Coastal Giant Salamander (streams and riparian habitat)
- Oregon Spotted Frog (shallow wetlands and marsh habitat)

Impacts of any degree on the habitat of threatened or endangered species can have catastrophic effects on species survival and should be avoided at all times. For some species at risk, there is no "window of least risk" during which instream works may be permitted. The risk of harm to the plant or animal remains high at all times.

Before planning any instream works, you should contact your local WLAP office for assessment and window information. You should also review the following website for further information on species at risk: <http://srmwww.gov.bc.ca/atrisk/>. In addition, the "Species Explorer" at

<http://srmwww.gov.bc.ca/atrisk/toolintro.html> can help you identify which species at risk may be in your area.