

Management Protocol for Red-legged Frogs and Western Toads BC Timber Sales Strait of Georgia Operating Areas – Version 1

E. Wind, RPBio. Nov. 30, 2010

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1.0 Introduction

BC Timber Sales (BCTS) in the Strait of Georgia Business Area must protect Species-at-Risk, including the Red-legged Frog (*Rana aurora*) and the Western Toad (*Anaxyrus boreas*), which are classified as *Special Concern* by COSEWIC and are *Schedule 1* species under the federal *Species at Risk Act*. Red-legged Frogs are forest dwelling amphibians that require both aquatic (wetland or ponds) and terrestrial habitats to complete their lifecycle. The frogs need terrestrial habitat for feeding and growth; whereas they require wetlands, fens, and bogs to reproduce. Breeding ponds/wetlands that are below 1000m in elevation and contain more than 50cm of standing water in early spring (during the egg laying season) are required. The breeding ponds/wetlands must also have low current velocities, retain standing water until at least August, contain a mosaic of open-water habitats and emergent vegetation, and have relatively open canopy-cover conditions. Red legged-frog adults are relatively common; however, their breeding sites are rare (<10% of sites; Wind 2003) and can influence the distribution of adults.

Western Toads utilize both terrestrial and aquatic (wetlands or ponds) habitats to complete their lifecycle. The toads require wetlands/ponds to breed and terrestrial habitat for feeding and growth. They require ponds that contain at least 50cm of standing water in early spring, as well as sites that have warm water areas with submerged/emergent vegetation for egg-laying. Similar to the Red-legged Frog, Western Toads require ponds that have low current velocities, retain standing water until at least August, contain a mosaic of open-water habitats and emergent vegetation, and have relatively open canopy-cover conditions. Although Western Toads range across much of BC, on the south coast (including Vancouver Island and the Sunshine Coast) populations are believed to be in decline and breeding sites are relatively rare, with the latter affecting the distribution of populations (Wind and Dupuis 2002).

Because the life histories and specifically the requirements for breeding sites for Western Toads and Red-legged Frogs are so similar, similar management strategies can be applied to both species. The following protocol outlines the management for both Red-legged Frog and Western Toad habitat, especially for breeding sites discovered on BCTS operating areas where Wildlife Habitat Areas (WHAs) are not being considered. As new information becomes available or as new policy is implemented, BCTS will review this protocol every five years to meet new requirements.

A Western Toad and Red-legged Frog identification key (Appendix 1) and the *Small Wetland and Amphibian Assessment Field Card*, by Wind, 2008 (Appendix 2), have been provided as appendices to this document. Appendix 3 also outlines various measures to consider when planning riparian buffers and management zones, as well as road layout and design for Western Toads and Red-legged Frogs.

2.0 Approach

This management protocol is based on the following principles:

1. To assess areas planned for development for potential Red-legged Frog and Western Toad habitat, especially breeding sites (ponds/wetlands).
 - Red-legged Frog adults are relatively common, but their breeding sites are rare (<10% of sites; Wind 2003) and influence the distribution of adults.
 - Although Western Toads range across much of BC, on the south coast (including Vancouver Island and the Sunshine Coast) populations are believed to be in decline and breeding sites are relatively rare, with the latter affecting the distribution of populations (Wind and Dupuis 2002).
2. To reduce the likelihood of loss of current breeding populations and sites (wetlands) as a result of BCTS forestry activities.
 - Adults may be attracted to ponds in cutover areas, which may then act as sink habitats (Proulx et al. 2003; Wind, unpublished data).
 - Retaining riparian wetland reserve and management zones may ameliorate the effects of timber harvesting.
 - Adult and juvenile toads can be attracted to roads, and are particularly susceptible to road mortalities during migration periods;
3. Minimize timber supply impacts through leveraging existing leave areas.
4. Where appropriate, to monitor the effectiveness of the reserve design and associated management to inform future iterations of the protocol.

3.0 Protocol

For proposed blocks *containing at least one W3, W4, L3, L4* (i.e., waterbodies that do not require riparian protection (reserve zones), within the range of the Red-legged Frog and Western Toad), *or Non-classified Wetlands (NCW) with the characteristics listed below*, an assessment by a Qualified Registered Professional (QRP) will be conducted to determine the probability of these waterbodies to be amphibian breeding sites. The QRP will use the *Small Wetland and Amphibian Assessment Field Card* developed by Wind (2008) to determine the probability that the wetland(s) is being used by Red-legged Frogs or Western Toads for breeding. The methodology on the field card is based on the size of the wetland, overhead canopy closure, presence of woody debris, and in-pond vegetation. This aquatic-based approach comes from the assumption that breeding sites are rare and are critical habitats, and the assumption that the majority of the population may occur within a few hundred meters of the breeding site (Semlitsch 1998).

- A Qualified Registered Professional (QRP) is defined as an applied scientist or technologist, acting alone or together with another QRP, specializing in a particular applied science including agrology, biology, forestry and/or engineering. The individual must be registered in good standing in British Columbia with their appropriate professional organization, acting under that association's Code of Ethics and subject to disciplinary action by that association. Through suitable education, experience, accreditation and knowledge, this person may be reasonably relied on to provide advice within their area of expertise (APEGBC, 2012 and MOE, 2012). A QRP includes, but is not limited to, those individuals with the following designations: Registered Professional Biologists (RPBio), Registered Professional Foresters (RPF), Registered Biology Technologists (RBTech), and Registered Forest Technologists (RFT).

Potential Red-legged Frog and Western Toad breeding ponds/wetlands include those that:

- Have low current velocities (less than 2cm/sec.)
- Retain standing water until at least August (larvae require approximately 4 to 5 months to metamorphose); a soft-bottom pond (i.e., build-up of humus/organic debris) may suggest longer hydroperiods
- Contain a mosaic of open water habitat (e.g., approximately 50%) and emergent vegetation, especially herbaceous plants and thin-stemmed graminoids (e.g., sedges, rushes, and grasses)
- Have relatively open canopy-cover conditions (e.g., less than 25% cover of trees and tall shrubs over the pond)
- **Red-legged Frog** breeding ponds are generally below 1,000m in elevation and contain more than 50cm of standing water in early spring (during the egg laying season).
- **Western Toad** breeding ponds contain at least 50cm of standing water in early spring (during the egg laying season) and include those sites that have warm water areas with submerged/emergent vegetation for egg-laying (shallow water or deeper areas with emergent/submerged vegetation near the surface). Western Toads are found from sea level to 2250m in elevation (Ministry of Environment, 2012a).

Surveys conducted in spring and early summer (e.g., March to June) may allow identification of Red-legged Frog and Western Toad tadpoles and/or eggs, and thus the identification of the wetland/lake as a breeding site. *See Appendix 1 for identification features of adults, egg masses, egg strings, and tadpoles.* Juvenile and adult Red-legged Frogs and Western Toads often disperse away from breeding sites into surrounding upland areas and are visible in and around a variety of forest, wetland and riverine habitats throughout the summer, but these observations do not necessarily indicate that these aquatic sites were used for breeding.

3.1 Initiation of this Protocol

This protocol is triggered upon discovery of a suspected Red-legged Frog or Western Toad (1) potential breeding site (e.g. W3, W4, L3, L4, or NCW) and/or (2) egg mass or tadpoles (Red-legged Frogs); or egg strings, tadpoles, or a mass dispersal of toadlets (Western Toads).

If the aforementioned items are discovered within a BCTS planned development area or within 50m of primary forest activities the protocol should be initiated. If the potential breeding site is located >50m from the planned development or primary forest activities; it is the decision of the QRP whether to initiate the protocol.

- Primary forest activities are defined as “one or more of the following: timber harvesting; silviculture treatments; and/or road construction, maintenance, and deactivation (Province of British Columbia, 2012)”

1) Potential Breeding Site (W3, W4, L3, L4 or NCW):

When wetlands have been identified, but breeding has not been confirmed, the QRP will use the *Small Wetland and Amphibian Assessment Field Card* developed by Wind (2008) to determine the probability that the wetland(s) is being used by Red-legged Frogs or Western Toads for breeding (see Appendix 2).

Red-legged Frogs and Western Toads have specific breeding requirements and breeding sites are relatively rare. Use of the field card ensures greater protection of wetland habitat and helps foresters prioritize retention within a block based on research and the species' biology. Habitat characteristics are measured for comparison to known features of Red-legged Frog and/or Western Toad breeding sites. Training on the proper use of the wetland assessment field card helps improve the accuracy of the assessment.

If the wetland/lake is confirmed as a breeding wetland, consult a professional biologist to work with the field team or contractor to develop a riparian management area and connectivity reserve. See section 3.2.1 for details on the design of the riparian management area and connectivity reserve.

- In wetlands/lakes with a **low** probability of breeding, follow the wetland management guidelines on the field card for small wetlands/lakes with a low probability of breeding and as well, follow the common management guidelines outlined on the *Small Wetland and Amphibian Assessment Field Card*.
 - Create a 5m machine-free zone around the wetland that contains shoreline vegetation.
- In wetlands/lakes with a **moderate** probability of breeding, follow the wetland management guidelines on the field card for small wetlands/lakes with a moderate probability of breeding and as well, follow the common management guidelines outlined on the *Small Wetland and Amphibian Assessment Field Card*.
 - Where possible, retain a windfirm, variable width, uncut or partial-cut buffer of at least 3m.
 - Ensure connectivity to upland forest and/or other wetlands whenever possible by maintaining a corridor of shrubs and non-merchantable trees that provides cover and retains moisture.
- In wetlands/lakes with a **high** probability of breeding follow the wetland management guidelines on the field card for wetlands/lakes with a high probability of breeding and as well, follow the common management guidelines outlined on the *Small Wetland and Amphibian Assessment Field Card* for riparian management to protect it from disturbance.
 - In order of preference:
 - Exclude the wetland from the block or include it within a retention area (≥ 0.25 ha) whenever possible.
 - Retain a windfirm, variable width, uncut, or partial buffer of 5 to 15m.

(2) Egg mass or tadpoles (Red-legged Frogs); or egg strings, tadpoles, or a mass dispersal of toadlets (Western Toads),

- If the above is observed within a planned development area or within 50m of primary forest activity, a Registered Professional Biologist (RPBio) should be consulted.

3.2 Consultation of a Professional

A Registered Professional Biologist should be consulted for the following reasons:

1. If the recommendations on the *Small Wetland and Amphibian Assessment Field Card (2008)* are not followed;
2. If Red-legged Frog or Western Toad eggs or tadpoles, or a mass toadlet migration, are observed in a planned development area;
3. If a management strategy is proposed that is outside the aforementioned guidelines;
4. If a breeding area is confirmed.

The professional biologist will work with the field team to design a riparian management area around occupied wetlands within or adjacent to the proposed cutblock.

3.2.1 Design of Riparian Management Area and Connectivity Reserve

If a Red-legged Frog or Western Toad breeding site is identified, the field team staff, in consultation with a biologist, will design a riparian management area around occupied wetlands within the proposed cutblock (of which some will meet wildlife tree retention targets and the rest may be a new reserve) with the following characteristics:

1. Windfirm (e.g., feathered, pruned) wetland riparian management area containing a minimum 10m reserve zone (i.e., from the edge of the wetland to 10m upland) and a 30m management zone. Maintain $\geq 10\%$ basal area, and retain multi-layered canopies, with understory growth and deciduous tree components in the management zone (see Appendix 3);
2. Where possible, windfirm corridors or tree patches will be retained between two or more occupied wetlands (i.e., wetlands with confirmed Red-legged Frog or Western Toad breeding) to facilitate movement between these habitats, or between an occupied wetland and adjacent old/mature forest cover (e.g., continuous timber, tree patches larger than 0.5ha);
3. Planned roads, falling, and yarding operations avoid crossing or impacting ponds and wetlands, if practicable (e.g., limbs kept out). All roads are suitably constructed to avoid physical damage to the wetland or impacts to water quality (e.g., siltation, slope failure, slumping). If practicable, road building within 50m of wetlands should occur outside of the breeding period (e.g., Aug. to Feb.) if possible; and,
4. Follows Identified Wildlife measures for access, harvesting, silviculture and Additional Management Considerations as much as practicable (IWMS, 2004).

Rationale:

- The design of the wetland riparian management areas needs to follow the ecological characteristics outlined in IWMS (2004) and Forest Stewardship Plans (FRPA 2004) as much as practicable in order to be effective, while still maintaining access to timber resources. This will require careful design of riparian management areas that uses existing leave areas. Other management actions, such as suitable road building and yarding practices are equally important to the success of the management protocol (e.g., building roads outside of the breeding season, and not allowing yarding operations through any waterbodies).

4.0 Reporting

If a high probability breeding site or a confirmed breeding site for Red-legged Frogs or Western Toads is found, the Woodlands Supervisor will notify the BCTS Planning Forester on discovery of the potential breeding site. Upon the completion of field verification of the breeding site and full documentation of it, the Planning Forester will contact the regional office of the Ministry of Environment and will submit full documentation (including relevant maps), design of riparian and connective patch reserves, and management plans to minimize impacts to ponds and wetlands.

BCTS Strait of Georgia will track all sites with a high probability of breeding or with confirmed breeding sites. The practices forester will identify the wetland to the GIS technician who will add it to the TSG Wildlife map layer.

Rationale:

- Monitoring species-at-risk is a core activity of the Ministry of Environment, and all information on the location and status of Red-legged Frog and Western Toad breeding sites is critical to the long-term management of the species.

5.0 Monitoring

If the aforementioned management strategies are followed and there is no future plan to alter the riparian reserve, then no monitoring plan is required to be implemented, unless the wetland/lake is a confirmed breeding site.

If a riparian reserve is proposed to be removed that is around a confirmed or potential (medium to high probability) breeding pond/wetland (W3, W4, L3, L4, or NCW), a monitoring plan should be implemented. The monitoring plan should consist of the following:

1. Confirmed breeding sites: The planning forester will ensure that confirmed breeding sites will be visited during the breeding season (typically March-June) to confirm breeding activity in each of the 3 years following harvest. If egg masses or tadpoles (Red-legged Frog) or egg strings or tadpoles (Western Toad) are not found during the initial survey within each year additional surveys will be conducted within that season for a maximum of three surveys per year. Results will be shared with the regional Ministry of Environment office and the field team.
2. Potential (medium or high) breeding sites: The planning forester will ensure that medium or high potential breeding sites will be visited during the breeding season (typically March-June) to confirm whether listed amphibian species are using the site for breeding. If so, the site is now considered a confirmed breeding site and step #1 and then step #3 (if required) will be followed.
3. Confirmed breeding sites: If occupancy is not detected for 3 consecutive years, the reserve can be removed. The biologist will attempt to determine the reason for the absence of breeding Red-legged Frogs or Western Toads and will provide recommendations for revising the management protocol if required.
4. The monitoring plan as well as the riparian reserve should be formalized through an adaptive management plan, in order to create an effective management zone for Red-legged Frogs and Western Toads.

Rationale:

- Because there are significant gaps in our knowledge of Red-legged Frog and Western Toad habitat relationships and responses to management (IWMS 2004), it is critical to monitor the response of Red-legged Frogs and Western Toads to the design of riparian management areas and related access, harvesting, and silviculture management. However, wetlands may become unsuitable for Red-legged Frogs or Western Toads for various reasons unrelated to forest harvesting, in which case reserves no longer occupied, as determined by the monitoring of occupancy, could be removed.

6.0 Adaptive Management

This protocol will be reviewed every 5 years (or as required, through continuous improvement), based on monitoring results and available literature related to Red-legged Frog and Western Toad biology and habitat management.

Rationale:

- An important aspect of adaptive management is the requirement to revisit and revise management strategies periodically to reflect the most recent information available.

7.0 Literature Cited

- FRPA. 2004. Forest Planning and Practices Regulation: Part 2. Forest Stewardship Plans and Part 4. Practice Requirements, Division 3 – Riparian Areas. B.C. Reg. 14/2004. Forest and Range Practices Act. Ministry of Forests and Range. Retrieved from <http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm>.
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Approved by:



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BCTS Strait of Georgia

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Appendix 1. Red-legged Frog and Western Toad Identification Key

To help in the identification of all life stages of Western Toads and Red-legged Frogs, obtain a copy of the following field guide which contains a key to adults, egg masses, hatchlings, and tadpoles:

Corkran, C.C., and C.R. Thoms. 2006. *Amphibians of Oregon, Washington, and British Columbia*. Lone Pine Publishing. Vancouver, BC. ISBN 1-55105-566-X

Recommendation: Become familiar with the guide before going into the field; place a coloured tab at the start of each native frog and toad species section for ease of reference and at the start of the identification keys at the back. Tabs should be placed at: Coastal Tailed Frog (when working on the mainland), Red-legged Frog, Western Toad, and Pacific Treefrog/Chorus Frog. The non-native Bullfrog and Green Frog occur along the south-coast as well, but are more common in rural/urban areas (except in the Powell River area, where they are becoming more common in backcountry areas).

Species	Adults and Juveniles	Eggs	Tadpoles
Western Toad	<p>Size: Adults can reach up to 14.5cm</p> <p>Colouring: Variety of colours, but usually have a light stripe down centre of back</p> <p>Distinguishing Features: Warty/bumpy looking skin; short back legs for crawling versus jumping</p>	<p>Description: Laid in strings among emergent vegetation, along shallow shoreline areas or near the water surface on top of vegetation in deeper areas</p> <p>Timing: Laid in April and visible for < 2 weeks near Nanaimo</p>	<p>Description: Black (difficult to see eyes); narrow tail fin; can reach up to 1.8cm body length</p> <p>Timing: Visible from May to July at lower elevations</p>
<p>Red-legged Frog</p> <p><i>Note:</i> most common at lower elevations – usually < 1,000m</p>	<p>Size: Body length of adults can reach up to 10cm</p> <p>Colouring: Tan to brown on back (may have some dark spots); dark eye mask and cream coloured lip line; underside of legs is translucent red; dark mottling in the groin area</p> <p>Distinguishing Features: Two dorsolateral folds run down the back starting behind the eyes; long back legs for jumping</p>	<p>Description: Relatively large (10-20cm diameter) round masses laid near the surface among vegetation; loose jelly; individual eggs visible along the surface (not smooth); mass may become fragmented, flat and/or floating as it ages; a green algal association may also be visible (may be confused with Northwestern Salamander)</p> <p>Timing: Laid in early spring (e.g., early March at elevations of 350m on eastern VI) and visible for a 4 to 6 week period.</p>	<p>Description: Brown with gold flecks along side and bottom; inset eyes when viewed from above; high arching tail fin; can reach up to 3.5cm body length</p> <p>Timing: Tadpoles are visible from April to July</p>

Species	Adults and Juveniles	Eggs	Tadpoles
<p>Coastal Tailed Frog</p> <p><i>Note:</i> on the mainland only</p>	<p>Size: Body length of adults can reach up to 5 cm</p> <p>Colouring: Tan to brown on back, with a light bar or triangle between the eyes and snout</p> <p>Distinguishing Features: Eyes have vertical pupils; males have a ‘tail’; outer toes on hind feet are flat and wide</p>	<p>Egg strings are rarely found; laid under large boulders in fast-flowing mountain creeks (e.g., S5 or 6)</p>	<p>Only found in fast-flowing mountain creeks (e.g., S5 or 6); visible all year</p>
<p>Pacific Treefrog / Chorus Frog</p>	<p>Size: Adults are ≤ 5 cm</p> <p>Colouring: Variable (tan to brown to green); may have long, brownish blotches on back; dark eye mask extends from snout to shoulder</p> <p>Distinguishing Features: Toe tips are rounded not tapered (have pads for climbing)</p>	<p>Description: Small (grape sized) round masses attached to emergent vegetation (e.g., grasses and rushes) in shallow water</p> <p>Timing: may be visible from March to June</p>	<p>Description: Tadpole eyes break the body outline when viewed from above; have an obvious ‘waist’; grayish with cream coloured underside; can reach up to 2.4 cm body length</p> <p>Timing: Visible from April to July</p>

To confirm presence, numerous surveys and techniques across a variety of seasons may be required.

Carry a digital camera (and clean, clear Ziploc bags) in order to take photos of amphibians observed in the field (take many photos from different angles). Photos can be sent to the BCTS contract RPBio to help confirm species identifications.

Appendix 2. Small Wetland and Amphibian Assessment Field Card, (Wind, 2008)

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

OBJECTIVE

This wetland assessment field card was designed to provide forest professionals with a tool to identify and manage priority aquatic-breeding amphibian habitat when retention options exist. It is meant as a guide only, to be used in addition to FRPA and other government standards. Forest professionals also need to be aware of other obligations that may exist, for example Wildlife Habitat Features.

Due to the coarse scale of the assessment, it is recommended that individuals *err on the side of caution* (i.e., choose a higher ranking) when unsure of the ranking of a wetland. For example, for wetlands that are borderline between two size classes use the larger class.

GUIDELINES FOR USING THE FIELD CARD

1. Determine the Wetland Riparian Class (W1-W5) and Riparian Management Area, if applicable—refer to the Ministry of Forests Riparian Classification Field Card FS 900A.
2. Determine the probability of amphibian breeding using the field card (page 2). Work your way through the flowchart of questions until you have obtained a low, medium, or high ranking for each wetland (note definitions).
3. Determine appropriate management practices based on your ranking and the guidelines on page 3.

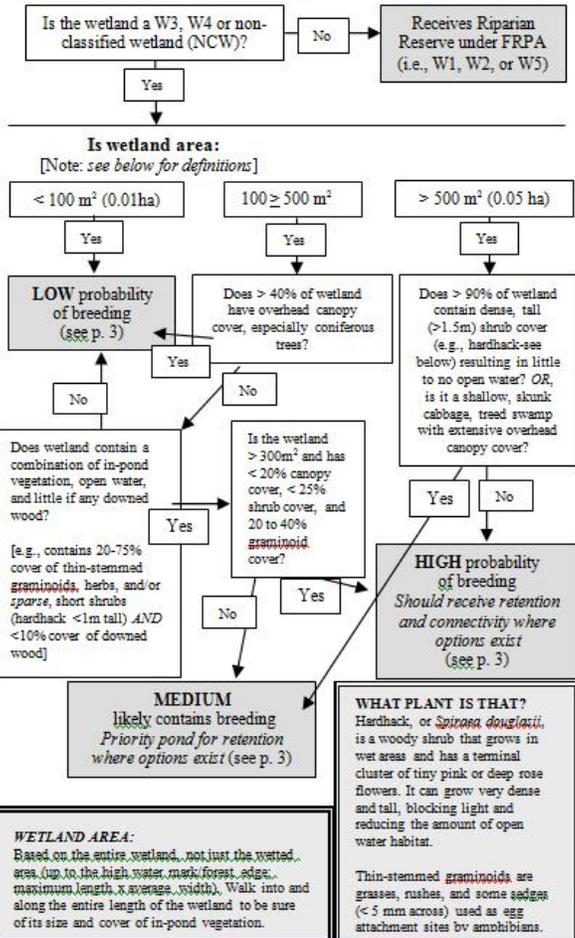
Please keep the following points in mind during your assessment:

- Accuracy will greatly improve if you have a complete view of the wetland—e.g., walk into or along the length of the wetland to view the entire wetland (to estimate area and cover).
- Wetlands vary extensively in physical appearance throughout the year (e.g., dry in August but 2m deep in April). Assessments during dry periods may be biased towards lower rankings. Look for the high water mark, envision the wetland with water (e.g., in early spring), and remember that wetlands that retain water until at least the end of June may be used for breeding.

WETLAND:

“... a swamp, marsh, bog, or similar area that supports natural vegetation, that is distinct from adjacent upland areas” (FRPA Riparian Guidelines)
For amphibians, this includes wetlands of all sizes and hydroperiods and ones that may contain little to no in-pond vegetation.

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD



SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

MANAGEMENT GUIDELINES BY RANKING

LOW probability of breeding:

- create a 5m machine-free zone around the wetland that contains shoreline vegetation (e.g., shrubs, non-merchantable trees)

MEDIUM probability of breeding:

- where possible, retain a windfirm, variable width, uncut or partial-cut buffer of at least 3m
- ensure connectivity to upland forest and/or other wetlands whenever possible by maintaining a corridor of shrubs and non-merchantable trees that provides cover and retains moisture

HIGH probability of breeding:

The management priorities are, in order of preference:

- exclude the wetland from the block or include it within a retention area (≥ 0.25 ha) whenever possible
- retain a windfirm, variable width, uncut or partial-cut buffer of 5 to 15m

Ensure connectivity to upland forest and/or other wetlands where possible by maintaining a corridor of shrubs and non-merchantable trees that provides cover and retains moisture

Wetland-breeding Amphibians of the South Coast:

Northwestern Salamander	Pacific Treefrog (or Chorus Frog)
Long-toed Salamander	Red-legged Frog*
Rough-skinned Newt	American Bullfrog (<i>non-native</i>)
Western Toad*	Green Frog (<i>non-native</i>)

* Species at Risk

Limitations on Use:

This card is based on data collected on wetlands located between 320-370 m on southeastern Vancouver Island (i.e., CWHxm). As such, it is most applicable to south coastal systems and species only. Habitat relationships and effects of forest harvesting outside of this area require additional research.

SMALL WETLAND & AMPHIBIAN ASSESSMENT FIELD CARD

COMMON MANAGEMENT GUIDELINES

1. **Prioritize retention by using the field card.** Additional factors to consider while using the field card include:

- Hydroperiod* – breeding is most likely in ponds that retain water until late June (a site visit in mid June is ideal for a small wetland assessment)
- Flow rates* – many pond-breeding amphibians are less likely to breed in flowing water (e.g., > 5 cm/sec.)
- Fishless sites* are high priority – fish prey on amphibians
- Where retention opportunities are limited, consider *less extensive or partial buffers* (e.g., south shoreline only)
- Protect *clusters of wetlands*
- Amphibians can become attracted to wetlands in cutblocks, but their survival rates are unknown.* As such, wetlands ranked as having a medium or low probability of breeding could benefit from retention or exclusion from the block to maintain riparian cover.

2. **Manage as many moderate and high priority wetlands as operationally feasible with windfirm buffers.** Where there is a high probability that some trees will fall into a wetland, windfirm (top or prune) or remove high-risk trees.

3. **Where possible, create connective corridors and linkages between wetlands, and between wetlands and surrounding forest,** by retaining shrubs and non-merchantable trees. ~~Designating these areas as machine-free zones, and falling and yarding away from these corridors, may facilitate amphibian movement.~~

4. **Fall and yard away from small wetlands. Remove introduced debris.**

5. **Where possible, avoid road locations near wetlands and employ sediment control measures as required.**

6. **Avoid planting in wetlands.**

7. **Do not spray herbicides or other pesticides over or near wetlands,** especially during the spring breeding season or mid summer (fall is the most suitable period).

Development of this field card supported by



Appendix 3. Things to Consider Regarding Riparian Buffers and Management Zones and Road Layout and Design for Red-legged Frogs and Western Toads.

Objectives of Riparian Buffers:

Riparian buffers may serve two main purposes:

- 1) to protect the integrity of the aquatic habitat (e.g., water temperature and quality), and
- 2) to provide terrestrial habitat for newly transformed juvenile amphibians (e.g., moist, cool microhabitats)

In order to provide adequate moisture and suitable temperatures within the terrestrial environment for small, newly transformed toadlets or newly emerged frogs (#2 above), riparian buffers may need to be larger. However, limitations may exist on the amount and/or configuration of retention that can be left at some blocks (e.g., when numerous small ponds exist throughout the block). In order to meet these objectives, it may be desirable to design some riparian buffers in ways that do not follow the standard 'donut' style configuration. For example, riparian buffers that are skewed towards the southwest section of the pond may shade the pond during the hottest part of the day and provide more suitable terrestrial habitat (e.g., be more windfirm and retain moisture longer; see Fig. 1).

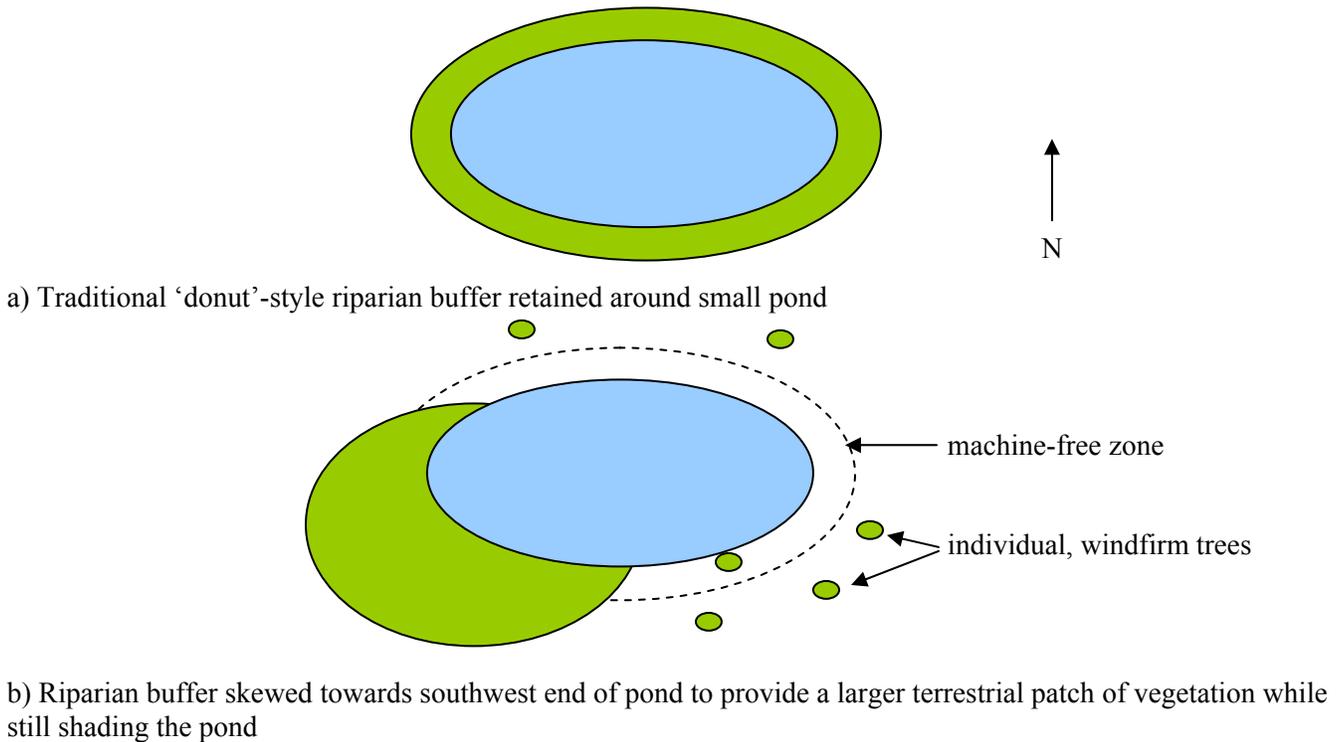


Figure 1. Riparian buffer option to protect both in-pond and terrestrial habitat.

When numerous ponds occur within a block, instead of retaining small patches of trees around many ponds, consider creating machine-free zones around the smaller ponds or those largely covered in Hardhack that may have short hydroperiods (e.g., those that dry in May or early June), and allocating extra retention around larger ponds with more open water and longer hydroperiods; these latter ponds are more likely to be utilized for breeding and/or provide moist habitats throughout summer. Ensure windfirm buffers by allocating extra trees to the buffer and/or pruning trees or feathering edges.

Besides breeding ponds, priority areas for retention for Western Toads and Red-legged Frogs include wet

depressions and streams. The minimum protection for all wet areas, ponds, springs, and creeks (regardless of size or hydroperiod) should include the hanging of machine-free ribbon along the perimeter to ensure that ground vegetation is protected, limbs and debris do not end up clogging these areas, and to avoid soil compaction, changes to water flows, etc.

Road Design and Layout

- Locate roads as far away from waterbodies and wet depressions as possible.
- Avoid placing roads between hillslopes and waterbodies as this will intercept/impede natural hydrological processes.
- Retain vegetation/riparian buffers along the shorelines of waterbodies and wet depressions adjacent to roads.
- Avoid creating ponded water areas adjacent to roads (i.e., in ditches and around culverts on upstream/upslope sides of roads).
- Design ditches to drain quickly (e.g., within a day). Install more, versus fewer, culverts to allow water to follow natural drainage patterns.