Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Fish and Aquatic Habitat Branch

Riparian Areas Protection Regulation
Technical Assessment MANUAL

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V. 1.1

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1. Introduction to the Assessment Methods

The Riparian Areas Protection Regulation (RAPR), enabled by the *Riparian Areas Protection Act* (formerly *Fish Protection Act),* came into effect on March 31, 2005 and was amended on November 1, 2019. This assessment methodology is presented as a Manual supporting the Regulation as provided for in the Act, ensuring that assessments are conducted to a standard level and that the standardized reporting format is followed.

The regulation requires a Qualified Environmental Professional (QEP) to provide an opinion in an Assessment Report that a proposed development will not take place in a Streamside Protection and Enhancement Area (SPEA), as determined by the methodology presented in this manual. The Assessment Report is submitted electronically to provincial and federal agencies to facilitate monitoring and compliance.

Prior to conducting an assessment QEPs should be familiar with RAPR objectives and the scientific rationale for the assessment methodology. The regulation is based on current science regarding fish habitat, while recognizing the challenges in achieving science-based standards in an urban environment.

This technical manual provides the intended interpretation of assessment methods specified in the RAPR; QEPs should ensure they are familiar with the language of the RAPR and the Riparian Areas Protection Act prior to preparing an Assessment Report. As the RAPR employs registered professionals, QEPs should also ensure that they are aware of and follow all applicable guidance from their professional association.

1.0 The Assessment Methods

This methodology has been developed to provide direction to QEPs on how to develop an Assessment Report to meet the provisions of the RAPR. As specified in part 4, div. 2, sec. 14 of the RAPR, a QEP must employ the assessment methods set out in the manual.

For required qualifications for QEPs under the RAPR refer to Part 4, Division 3 of the regulation.

For required contents of an *assessment report* and reporting requirements refer to Part 4, Division 2 of the regulation.

1.1 Preparing an Assessment Report

An Assessment Report contains the results of a Riparian Assessment. Proponents must provide an Assessment Report in support of their development application to the appropriate Local Government if they are proposing development within the Riparian Assessment Area (RAA) as defined in the regulation.

Where a Local Government has in place a "*meet or exceed*" approach to the RAPR as referenced in Part 1, Division 2, Section 2 of the regulation and defined in section 12 of the Riparian Areas Protection Act, required submissions may vary. The development proponent and QEP should ensure that they are knowledgeable regarding local standards prior to undertaking an assessment using the Assessment Methods.

The Assessment Report specifies the appropriate SPEA width by following the applicable methodology and outlines the measures required to maintain the integrity of the SPEA if required by the class of assessment.

For the definition of *riparian assessment area* and *streamside protection and enhancement area,* refer to Part 1, Division 1 of the regulation.

All Assessment Reports are to be submitted by a Primary Qualified Environmental Professional (QEP) with expertise appropriate to the evaluation being performed, as defined in Part 1, Division 1 of the RAPR. Secondary QEPs with specialized expertise may be required to provide advice where site characteristics warrant.

It is the responsibility of the primary QEP for the project to ensure that specialized QEPs are consulted where appropriate.

The Assessment Report has been designed to be commensurate with the nature of the site conditions and the development proposed. Its contents permit review and auditing by regulatory agencies to determine compliance with the Assessment Methods and compliance of the developer with the recommendations of the QEP.

The Assessment Report must be filed electronically to the Riparian Areas Protection Regulation Notification System (RARNS), accessible though the ministry web page.

Determining the Riparian Assessment Area (RAA)

For the definition of *ravine* refer to Part 1, Division 1 of the Regulation.

The Assessment Area is established as per figures 1-1 and 1-2 below.

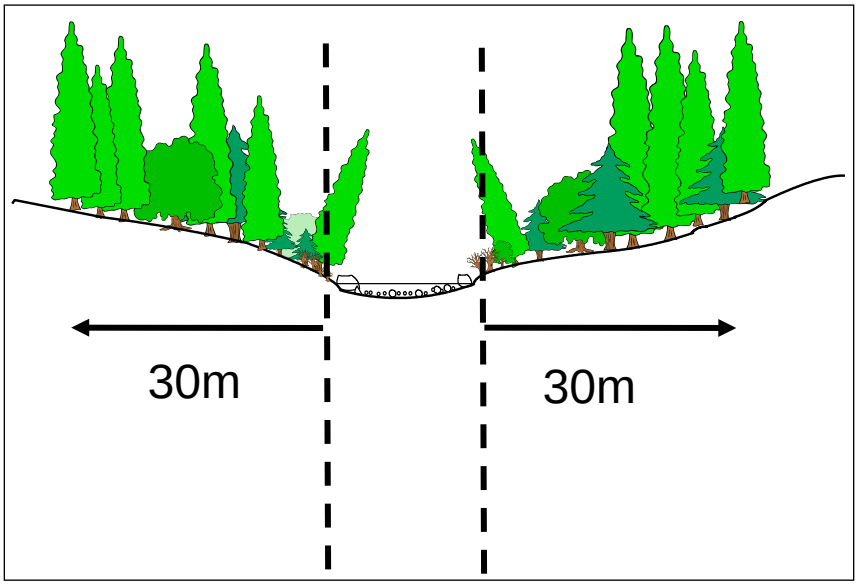


Figure 1-1: Assessment Area

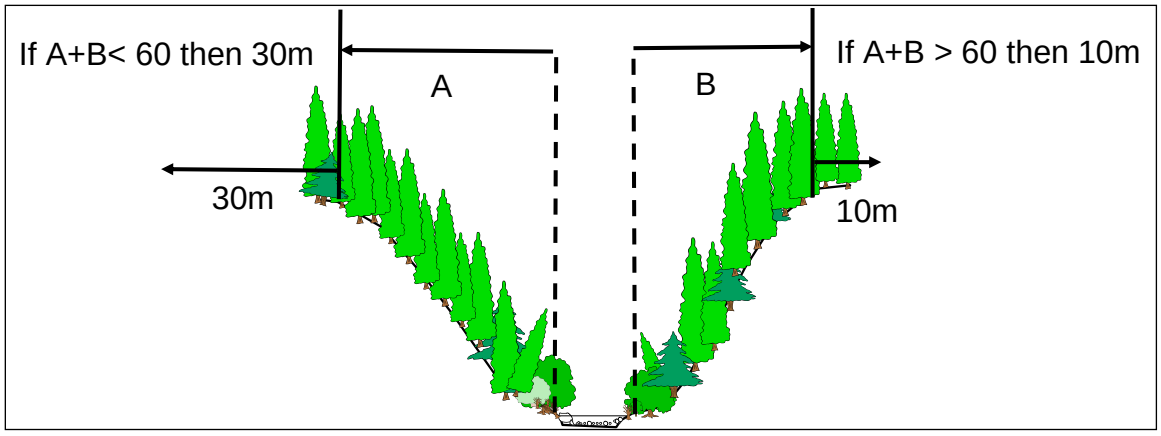


Figure 1-2: Assessment Area for ravines

1.1.1: Use of different methodologies:

The methodology used to complete the assessment must be as described in Section 13 of the regulation.

1.2 Assessment Report Contents – all methodologies

The required contents of an assessment report are defined in Division 2 of the regulation and are further detailed in these methods. As described in Section 14 (b), an assessment report must include the information identified in sections 15-19 and the direction found in this technical manual.

A completed Assessment Report must be filed electronically to the Riparian Areas Regulation Notification System.

All Assessment Reports **must include** the following sections:

1.2.1 Description of Fisheries Resources Values and Riparian Condition

The information included in this section is to be used by the QEP to determine appropriate measures to protect the integrity of the SPEA and should be directly informed by the assessment methods. A summary of the species that frequent the waterbody, types of fish habitat present (e.g. spawning, rearing, over-wintering, or migration) and a description of the present riparian vegetation condition must be provided.

Values of areas tenuously connected to fish habitat and assessments of barriers to fish movement should be described here. Where connectivity between a waterbody and areas of fish use is debatable, a description of the spatial and temporal connection and value for fish of food and nutrients derived from the waterbody should be discussed here with sufficient justification and validation.

1.2.2 Description of Development Proposal

This section should clearly outline all development activities reviewed as part of the assessment report, as described in Sections 15 and 18 of the regulation. The QEP must identify if it is residential, commercial or industrial development and ensure that they obtain sufficient detail from the proponent to describe all components of the proposed development. This must include all development activities that are ancillary to residential, commercial and industrial development, including but not limited to:

- Outbuildings, sheds, gazebos and other secondary / ancillary structures
- Driveways, parking areas, impervious and semi-pervious pathways/walkways
- Movement of soil / regrading, installation of retaining walls and other “hard” landscaping
- Decks, cantilevered / overhanging structures

Only the components of development specifically referenced in the assessment report will be considered as reviewed by the submitting QEP. A QEP should not submit a report including conceptual, speculative or absent information on the proposed development as this may lead to the report being rejected by the ministry.

1.2.3 Results of the SPEA and ZOS determination

Where the Simple Assessment is used, the measurements and calculations used to determine the SPEA width must be clearly shown in this section. Where the Detailed Methodology is used the

measurements and calculations for each Zone of Sensitivity must be provided as well as the resultant SPEA width and all **measures** described in the detailed methodology section (see section 1.3.1). Where the QEP has classified the stream as a ditch as defined in section 3.6.5, justification must be provided for this conclusion as per the specifications in this manual.

1.2.4 Site Plan

A clear and legible site plan must be included. The site plan must be of the appropriate size and scale to show the information required in the regulation. As described in **section 18(2)(h)** of the regulation, an orthophoto must also be included showing both the Riparian Assessment Area and the SPEA.

The site plan must show all proposed development, including both primary development (e.g. buildings) and all ancillary development (including but not limited to, servicing, walls, roads, trails, docks). Local governments may have requirements for development site plans that do not include all the components required by the RAPR; the proponent should ensure the appropriate scale and detail is provided. The site plan must be at a sufficient resolution to be reproduced at the original scale submitted to local government for approval. **The site plan must show the width of the various zones of sensitivity (ZOS) and the resulting SPEA width, including setbacks from the either the Top of Bank or Top of Ravine Bank (Simple Assessment) or the Stream Boundary (Detailed Assessment).**

1.2.5 Photos

Photographs of the site condition including the area proposed for development are required. QEPs should provide as many photos as are necessary to illustrate the nature of the riparian area and any significant fish habitat features, including significant/notable vegetation. Photos must clearly show the location of the proposed development in relation to the stream(s) under assessment and the area immediately surrounding the development footprint. This should include photos taken from the upland area towards the stream and vice versa.

The QEP should endeavour to locate photo reference points that are easily located and repeatable, both for the purposes of post-development monitoring and ministry auditing.

1.2.6 Professional Opinion

The QEP must certify the content of the Assessment Report and all associated statements as per section 19 of the RAPR and additionally in the case of *undue hardship*, section 11 of the RAPR.

1.3 Additional Assessment Report Contents – Detailed Assessment

Where the Detailed Assessment methodology is used, the Assessment Report must also include the following sections, in addition to those outlined in section 1.2.

1.3.1 Measures to Protect and Maintain the SPEA

A description of all Measures that will be taken to maintain and protect the SPEA from development must be included in the Assessment Report if the Detailed Assessment is used. The measures that must be considered are;

- assessment and treatment of danger trees,
- windthrow,
- slope stability,
- tree protection during construction,
- prevention of encroachment,
- sediment and erosion control,
- floodplain, and
- stormwater.

The requirement for measures is found in section 16 of the regulation and further detailed in Section 15(2)(c).

The only Measure permitted within the SPEA is the treatment of hazard trees as assessed by a QEP with provincial hazard tree training.

Some measures will result in areas beyond the SPEA being identified as areas requiring special protection or limited activity to protect and maintain the SPEA. For example, addressing windthrow may require the creation of a wind firm buffer outside of the SPEA.

The content of some measures may require retaining secondary QEPs with specialized expertise. All QEPs must provide advice only within their area of expertise.

1.3.2 Environmental Monitoring

This section identifies the actions that will be taken to ensure all proposed activities are completed as described. It will include a monitoring schedule and process for resolving any non-compliance on the site. A communication plan for site workers is strongly recommended. The appropriate level of knowledge, training and experience for all site environmental monitors should be specified.

1.4 Sign-off and Submitting an Assessment Report

The Assessment Report must be prepared and signed by all the QEPs that contributed to and share responsibility for the report. A QEP must certify at all points indicated in the report templates those components of the assessment for which they were the QEP. The primary QEP must retain a signed hardcopy of the Assessment Report on file at their normal place of work. The Assessment Report, once submitted, is used by the proponent to support their development application to Local Government

An Assessment Report may only be submitted where the QEP can appropriately certify its contents as per section 19 of the regulation.

1.5 Does the RAPR Apply to the Proposal

1.5.1 Types of Development

For the definition of *development* and *Area of Human Disturbance* refer to Part 1, Division 1 of the regulation.

For descriptions of applicable developments under the regulation refer to section 3(1).

The regulation applies to local government regulation or approval of residential, commercial or industrial development or ancillary development under their jurisdiction in Part 14 [Planning and Land Use Management] of the *Local Government Act*.

The Riparian Areas Regulation does not apply to:

- Development in the circumstances described in section 3(3) of the regulation.

- Existing permanent structures, roads and land use within SPEAs may be considered an "***area of human disturbance****"* as defined in section 1(1) of the regulation. The Regulation has no effect on any repair or reconstruction of a permanent structure on its existing foundation and within its existing footprint as described in section 3(3) of the regulation.

- Farming **activities** as defined in the *Farm Practices Protection* (Right to Farm) *Act* are not subject to the Regulation. Farming activities may be subject to other provincial legislation or guidelines and must in all cases be compliant with the federal *Fisheries Act*. The ministry of Agriculture has produced a series of riparian factsheets that offer guidance on best management practices for agricultural activities. While the Regulation does not apply to farming activities as defined in the *Farm Practices Protection Act*, it does apply to residential, commercial and industrial development in the Agricultural Land Reserve and on lands that are used, designated, or zoned for agriculture.

- Mining activities, hydroelectric facilities and forestry activities (on Crown land or privately managed forest lands as defined under the *Private Managed Forest Land Act*) are not subject to the regulation, as these land uses are regulated by other provincial and federal legislation and not by local governments. As local governments may regulate how and where mineral or forest products are processed, such activities may be considered industrial or commercial activities for the purposes of bylaws and would then be subject to the RAPR.

- Federal lands and First Nations reserve lands are not subject to the Regulation in that they are typically exempt from local government bylaws.

- Development activities taking place in park lands under local government jurisdiction are typically exempt from permit requirements and would not be subject to the regulation. In some cases, activities may be proposed in parks that constitute commercial or industrial development and therefore subject to the regulation. The QEP and proponent should confirm bylaw requirements with the local government.

- The RAPR does not apply to institutional developments, but these are subject to the Federal Fisheries Act and Provincial Water Sustainability Act. Where an institutional development includes development activities within the riparian area, it is recommended that the developer

seek advice from a qualified environmental professional(s) and secure the necessary approvals for meeting applicable regulatory requirements. The applicable local government bylaws will establish if a given development qualifies as Institutional

It should be noted that where the regulation does not apply to a given activity, that activity may still be subject to the requirements of the federal *Fisheries Act.*

1.5.2 Streams under the Riparian Areas Protection Regulation

For the definitions of *stream* and *protected fish* refer to Division 1, Section 1 of the Regulation.

The definition of *game fish* in the Regulation has the same meaning as in the federal *Fisheries Act Regulations.*

The RAPR defines a *stream* as any watercourse providing fish habitat, natural or human-made that contains water on a perennial or seasonal basis and is scoured by water or contains observable deposits of mineral alluvium; or has a continuous channel bed including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A stream may not be currently inhabited by fish, but may provide water, food and nutrients to other streams that do support fish.

Side channels, intermittent streams, seasonally wetted contiguous areas are included by the definition of a stream which includes active floodplains and wetlands connected to streams.

Fish subject to the regulation are specifically defined. The definition of fish includes salmonids, game fish, and fish that are listed in Schedule 1, 2 or 3 of the *Species at Risk Act* (Canada). Aquatic species that are endangered or threatened either provincially or nationally may have requirements in excess of the level of protection identified under the Riparian Areas Regulations. QEPs should review Species Recovery Plans or contact ministry / Fisheries and Oceans Canada (DFO) staff regarding the specific needs of these species.

The RAPR does not apply to marine or estuarine shorelines; these waters are still considered fish habitat but are under the jurisdiction of DFO through the Fisheries Act. Fisheries and Oceans Canada should be contacted regarding appropriate setback widths in marine and estuarine areas to ensure that development activities do not impact fish habitat. The boundary between freshwater habitats and estuarine habitats is considered the upstream extent of tidal influence. Streams that do not contain fish and that flow directly to the ocean may have high fish utilization of their estuary; contact DFO regarding the level of riparian protection required on these watercourses.

In general, the only watercourses excluded from the definition of stream under the RAPR are those that do not support fish or drain into a watercourse that supports fish; e.g., an isolated wetland that is not connected to a stream system; or a roadside ditch that is not directly connected to a fish-bearing stream.

The key question in determining if a watercourse is a stream under the RAPR is whether it connected by surface flow to a stream that provides fish habitat. If so, then it **is** a stream under the RAPR. Surface flow means that the water is moving above the bed of the stream; water flowing through a culvert does not constitute subsurface flow. **Where a stream periodically**

flows subsurface but flows above the surface part of the year this would constitute a stream under the RAPR.

This means that many streams that are referred to colloquially as “ditches” are considered streams under the regulation and will require an Assessment Report to be prepared. Under the Detailed Assessment ditches are considered differently than natural or channelized streams recognizing that ditches have specific habitat values.

2.0 Conducting a Simple Assessment

The Simple Assessment originates from the method established in the former *Streamside Protection Regulation*. The Simple Assessment sets out widths for SPEAs based on certain stream characteristics – fish-bearing status, nature of stream flows and the status of streamside vegetation. These widths have been defined for the protection of fish habitat, tempered by the feasibility of applying these widths in previously developed areas.

Determining the SPEA using the Simple Assessment

Determining a SPEA using the Simple Assessment requires answering the following key questions:

1. What is the width and status of the ***existing and potential streamside vegetation***?
2. Is the stream currently or potentially ***fish-bearing***? Or is it tributary to a fish-bearing stream?
3. (For a few, limited situations) is the stream flow ***permanent*** or ***non permanent***?

The QEP has the option of assuming defaults as outlined below in Table 2.1 for each question and then applying the 30 m buffer width listed in Table 2-4 as outlined in section 2.4

Table 2.1 30m default

Question	Default
What is the width and status of the ***existing and potential streamside vegetation****?*	Category 1
Is the stream currently or potentially ***fish-bearing****?*	Yes
Is the stream ***permanent*** or ***non permanent****?*	Permanent

2.1 Determining the Status of Existing and Potential Vegetation

The vegetation category is assessed within a 30m wide area starting from the middle of the subject site and going 200m both upstream and downstream on the bank(s) where the development will occur. An air photo can be used to undertake this measurement providing it is of a scale and resolution sufficient to determine the type of structures and the QEP confirms by a site visit that no changes have occurred to the area since the date that the air photo was taken. Where adequate air photo coverage is unavailable, ground transects should be used, provided permission to access to upstream and downstream properties can be obtained. Below are the directions on how to calculate the vegetation category:

1. Draw on the air photo the 30m and 200m assessment boundaries.

2. Mark all permanent structures in this area. **For the purposes of this evaluation only, permanent structures includes only buildings with foundations.** Table 2-3 found later in this chapter provides guidance on permanent structures for the purpose of grandfathering structures in the SPEA. Field checking an aerial or orthophoto interpretation is particularly important where land uses have changed or structures and clearings are difficult to interpret
3. At a minimum of every 40 metres, beginning at the midpoint of the lot, measure the distance from the TOB (at right angles to the stream) to the first permanent structure. Road crossings should not be included in assessments - move further upstream or downstream to account for a loss of linear length in assessment area. Record each distance.
4. Add all these distances and determine the average potential riparian width and apply formula in Table 2-2.

Table 2-2 Average Potential Riparian Width Results and Vegetation Category for the Simple Assessment

Average Potential Riparian Width	Category
greater than 15m	**1**
10 - 15m	**2**
less than 10m	**3**

Figure 2-1 on page 16 illustrates this method, with the average potential riparian width of 28 m resulting in Vegetation Category 1.

Figure 2-1: Example of determining of vegetation category for Simple Assessment

Note that a previously developed streamside site could become "potential" vegetation if redevelopment is proposed that involves removing one or more permanent structures. In that case, reclaiming and restoring a streamside area to a vegetated state could form part of the subsequent development approval. Table 2-3 provides guidance on what is considered a permanent structure for the purpose of determining potential vegetation width under the simple assessment. When using the Simple Assessment there are some situations where the location of the permanent structure will influence the location of the SPEA (see section 2-4 and 2-5).

Field check: Field checking an aerial or orthophoto interpretation is particularly important where land uses have changed or structures and clearings are difficult to interpret.

Table 2-3: Examples of permanent structures for the purposes of establishing areas of vegetation potential when using the simple assessment method

Structure	
Building	**Permanent** if constructed and compliant with permits, approvals and standards required at the time of construction; this includes buildings that pre-date current permitting processes but which are considered "legal non-conforming".
Public road	**Permanent** if the road alignment is consistent with a current transportation plan and cannot be changed.
Private road	**Permanent** if it is required as access for an existing use that is not subject to change (i.e., not subject to redevelopment, rezoning or subdivision wherein road alignment could change).
Temporary access	**Temporary** if an alternative, permanent access will be developed as part of site development.
Parking area	**Permanent** if it is associated with a permitted structure and is required to meet minimum local government parking standards for the existing use (i.e., parking area cannot be reduced, altered, moved or relocated). **Temporary** if the area is subject to new development, redevelopment, rezoning or subdivision, is not associated with a permanent structure, and/or the parking area can be reduced, or reasonably altered, or relocated.
Landscaped area	**Temporary** if it could be modified over time to provide more natural riparian conditions
Playing field, playground or golf course	**Permanent -** however, there may be room and opportunity to relocate structures or allow streamside areas to be 'naturalized' without compromising the recreational use. **Temporary** if the land is being used in this capacity in the short term, while being held for another recreational or other purpose.
Trail	**Permanent** if it is an integral part of an existing or approved trail network, has been in use for an extended period of time and/or there is no room or opportunity to relocate it. **Temporary** if it does not have structures (i.e.: boardwalks, viewing platforms, access control structures, bridges) associated with it or there is room or opportunity to relocate the trail, especially portions that are degrading streambanks and riparian vegetation.
Outdoor storage associated with a commercial, industrial or utility operation	**Permanent** if it is associated with a permitted structure, the existing use of which is to be retained, storage use is in compliance with all other appropriate legislation, and storage area cannot be reduced, altered, moved or relocated. **Temporary** if the existing property use will not be retained; the site is subject to new development, redevelopment, rezoning or subdivision; the storage facility would not be considered a permitted structure; and/or the storage area can be reduced altered, moved or relocated.
Utility works and services	**Permanent** if it is an authorized use in compliance with all other appropriate legislation. Where the utility is underground for which a right of way exists for servicing purposes, the

	right of way within the streamside area should be naturalized or revegetated with minimum vegetation clearing to allow service vehicle access to the area.
Dikes, levees	**Permanent** if the structure is provincially or federally approved and intended to provide long-term flood protection to associated properties. **Temporary** if the structure is not intended to provide long term protection, may be feasibly moved back or realigned, or is planned to be decommissioned as part of an infrastructure renewal program.

2.2 Determining if the Stream is Fish-Bearing

The definition of fish is found in Division 1, Section 1 of the RAPR.

Fish-bearing streams are ones in which fish are present or *potentially* present if introduced obstructions could be made passable. The QEP may use the default position of assuming that fish are present and use the applicable SPEA standard for a fish-bearing stream.

2.2.1 Information Sources to Confirm Fish Presence

If it is not known whether a stream supports fish, there are a few resources to check to see if others have found fish in that system. These sources cannot be used to establish fish absence (see section 2.2.2 below).

The Fisheries Information Summary System (FISS) is maintained by the Ministry of Environment and Fisheries and Oceans Canada and can be accessed through their websites. It provides maps of streams indicating fish presence and habitat value. However, at a scale of 1:20,000, the FISS misses many small streams that may contain fish in urban and rural areas.

The Community Mapping Network has fish presence information and other thematic maps at a 1:5,000 scale for the Georgia Basin and Central Okanagan.

- Staff at regional ministry offices or local government environmental staff may have data on fish presence in local streams.
- Stewardship groups or local residents may also be sources of documented or undocumented information. Though the information may be anecdotal, it can still provide the basis for choosing whether to conduct a field assessment.

2.2.2 Determining Fish Absence

Fish Absence can be affirmed under the simple assessment using the three methods outlined below. Note that fish absence is only relevant to the simple assessment methodology in determining fish-bearing status and in the detailed assessment when assessing Ditches.

1. Using stream gradient (Section 2.2.2.1)

2. Evaluating man made barriers to fish passage (Section 2.2.2.2)

3. Undertaking sampling to confirm fish absence (Section 2.2.2.3)

As described below the QEP may need to employ more than one of these methods to confirm fish are absent from the area of concern.

Non-fish-bearing streams are still protected under the RAPR if they provide water, food or nutrients to a fish-bearing stream.

2.2.2.1 Fish Absence Based on Stream Gradient

Stream reaches with a stream slope greater than 20% are not considered fish-bearing for the purposes of applying the Simple Assessment methodology. However, fish such as cutthroat trout, bull trout, Dolly Varden char and sometimes rainbow trout have been observed to occur in very steep streams, well in excess of 20% slope. Where a reach has a stream gradient >20% and a stepped-pool profile and (or) where a lake occurs at the head of the drainage, or there is perennial fish habitat above a barrier the methodology found in Appendix 3 must be employed to determine fish presence/absence. Impassible conditions or barriers where no reasonable potential for fish presence can be expected include:

- Natural impassable barriers such as falls or steep cascades at tidal boundary that are too high even in high flow periods for fish to jump.
- Human made permanent barriers that cannot be reasonably modified to allow fish passage; e.g., large weirs or dams

When fish are found in a given reach; that reach is to be identified, classified and managed as a fish-bearing stream reach regardless of its slope.

2.2.2.2 Man Made Barriers to Fish Passage

It may be necessary to conduct an assessment of man made barriers to fish passage. Where these circumstances exist the QEP must provide sufficient documentation in the Assessment Report to confirm the existence of a "permanent" man made barrier. This should include providing measurements of the barrier, calculations of flows where this is identified as the problem, and confirmation from responsible authorities that a man made barrier cannot be reasonably modified or replaced with a passable structure. If the man made barrier can be made accessible then the stream is to be considered fish bearing. Depending on the situation, there may also be a need to conduct an assessment upstream of the barrier following the methodology in Appendix 3 to confirm that resident fish populations do not exist (i.e. there is year round flow or a lake above the barrier).

2.2.2.3 Methodology to Confirm Fish Absence

Where stream gradient or barriers are not factors, the methodology found in Appendix 3 must be employed to determine fish presence/absence. Documentation of the methods employed to determine fish absence is required to be included in the RAPR Assessment Report. As noted in the above sections, there may be a need to undertake this assessment in association with stream gradient and barrier situations.

2.3 Determining Stream Permanence

For the purposes of determining stream permanence only under this methodology, the following definitions apply:

Permanent stream means a stream that typically contains continuous surface waters or flows for periods more than 6 months in duration

Non-permanent stream means a stream that typically contains continuous surface waters or flows for a period less than 6 months in duration

Stream flow permanence is a factor only in determining a SPEA on non-fish bearing streams with existing or potential vegetation greater than 30 m in width. Here, the minimum SPEA width is either 15 or 30 m depending on whether or not the stream is classified as *permanent*.

Some streams have flow records and these can be referenced to determine stream permanence. It is important to keep in mind that the default value is permanent. If deviating from the default value, the QEP must adequately document their rationale in the Assessment Report which should include flow records over multiple years.

As described in Section 1, surface flow means flow that is not below the bed of the stream. Flow contained within a culvert is considered surface flow. Lakes and wetlands are always considered to have permanent flow.

2.4 Calculating the SPEA for the Simple Assessment

Once answers to the key questions are determined the SPEA can be determined from Table 2-4., except for Ravines greater than 60 meters in width where the SPEA is 10 meters beyond the top of the ravine bank (Section 2.5.4.1). For three combinations there are multiple outcomes that are based on the location of permanent structures (Figures 2-2 and 2-3).

<table>
<tr><th rowspan="3">Vegetation Category</th><th rowspan="3">Existing or potential streamside vegetation conditions</th><th colspan="3">Streamside Protection and Enhancement Area Width*</th></tr>
<tr><th rowspan="2">Fish bearing</th><th colspan="2">Non-Fish bearing</th></tr>
<tr><th>Permanent</th><th>Non Permanent</th></tr>
<tr><td>1</td><td>Continuous areas ≥30 m or discontinuous but occasionally > 30 m to 50 m</td><td colspan="2">30 m</td><td>Minimum 15 m
Maximum 30m
Refer to Figure 2-2</td></tr>
<tr><td>2</td><td>Narrow but continuous areas = 15 m or discontinuous but occasionally > 15 m to 30 m</td><td>Minimum 15
Maximum 30
Refer to Figure 2-2</td><td colspan="2">15 m</td></tr>
<tr><td>3</td><td>Very narrow but continuous areas up to 5 m or discontinuous but occasionally > 5 m to 15 m</td><td>15 m</td><td colspan="2">Minimum 5m
Maximum 15 m
Refer to Figure 2-3</td></tr>
</table>

Table 2-4: Streamside Protection and Enhancement Area Widths for the Simple Assessment

***SPEA is measured from Top of Bank or Top of Ravine Bank.**

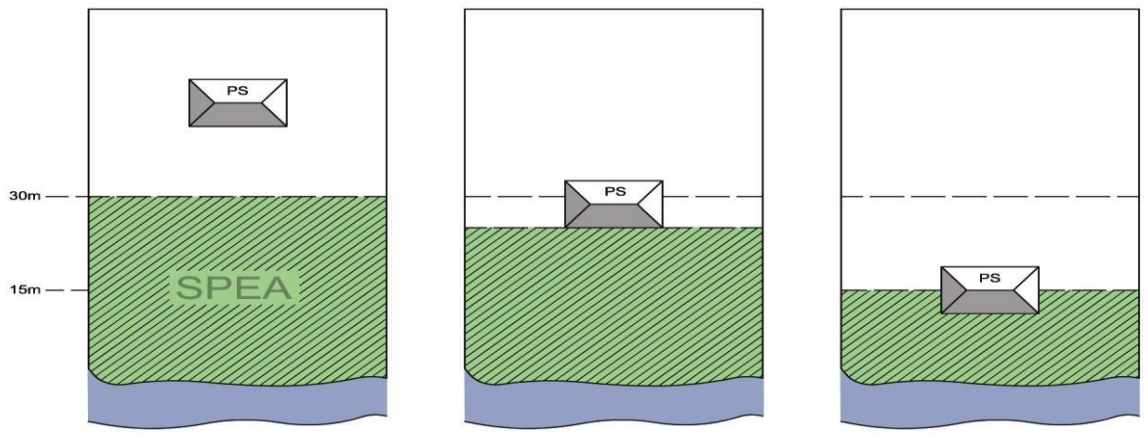
For the purposes of determining top of bank under this methodology, the following definition applies:

Top of bank means

(a) the point closest to the boundary of the active floodplain of a stream where a break in the slope of the land occurs such that the grade beyond the break is flatter than 3:1 at any point for a minimum distance of 15 metres measured perpendicularly from the break, and

(b) for a floodplain area not contained in a ravine, the edge of the active floodplain of a stream where the slope of the land beyond the edge is flatter than 3:1 at any point for a minimum distance of 15 metres measured perpendicularly from the edge.

Figure 2-2 Determining SPEA width for Vegetation Category 1/non-fish bearing/non permanent and Vegetation Category 2/Fish bearing.

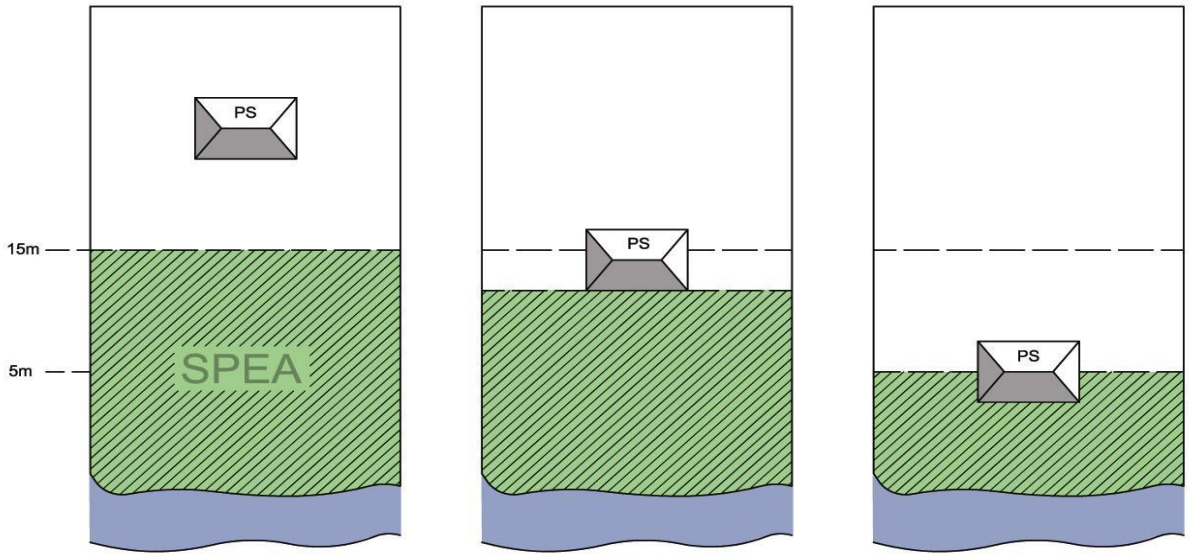


No Permanent Structures (PS) within 30m of TOB.
SPEA = 30m from TOB

PS between 15-30 m from TOB.
SPEA = distance from TOB to the closest point of PS

PS < 15m from TOB.
SPEA = 15m from TOB

Figure 2-3 Determining SPEA width for Vegetation Category 3/non-fish bearing



No Permanent Structures (PS) within 15m of TOB.
SPEA = 15m from TOB

PS between 5-15 m from TOB.
SPEA = distance from TOB to the closest point of PS

PS < 5m from TOB.
SPEA = 5m from TOB

2.5 Laying out the SPEA Under the Simple Assessment

2.5.1 Permanent Structures

When using the Simple Assessment, there are some situations where the location of the permanent structure will influence the location of the SPEA. Table 2-3 provides further guidance on grandparenting "permanent structures" for the purposes of the Simple Assessment.

2.5.2 Wide Lots

Where a property is subdivided and an original structure is located on a portion of the parent lot, the SPEA determined based on the presence of a permanent structure will apply only to the property where the original structure is located. For example, if a property was subdivided into five lots and only one of those lots contained the original permanent structure, the lot with the permanent structure will have the SPEA based on the location of the permanent structure and the four remaining lots will have the maximum SPEA width from Table 2-2.

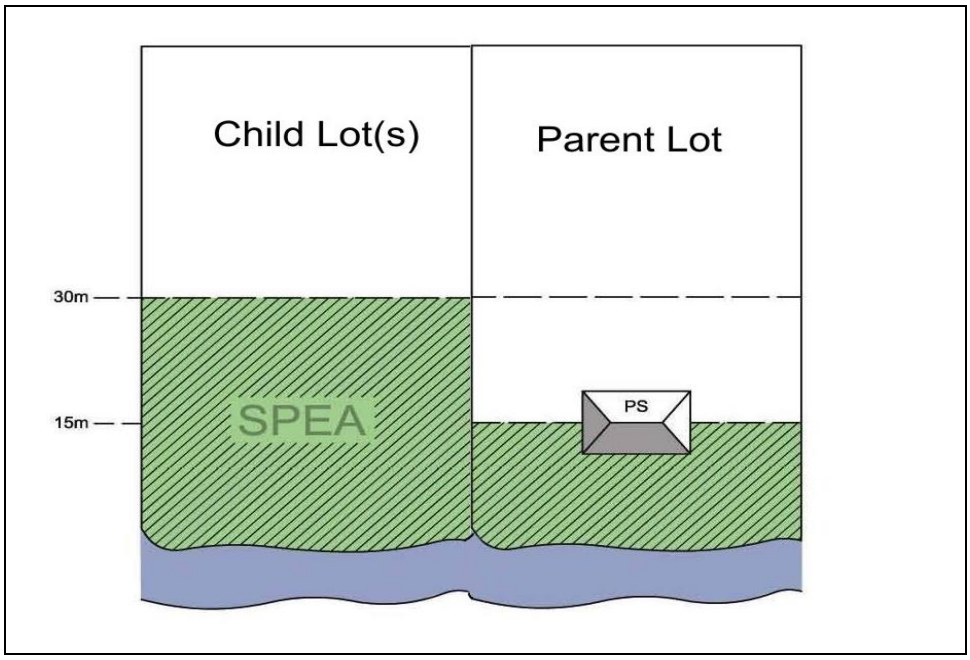


Figure 2-4 Example of Wide Lot Scenario. The SPEA is reduced only on the Parent Lot based on the original Permanent Structure Child lots where there are no permanent structures have the maximum SPEA width for their Vegetation Category/Fish Bearing Status.

2.5.3 Roads

Where a road is located between the subject property and the stream the SPEA should still be provided for on the other side of the road. In many cases trees on the other side of the road will still provide valuable shade and litter fall and insect drop to the stream. Clearly, the provision of Large Woody Debris (LWD) to the stream will be limited due to safety requirements for the road.

2.5.4 Establishing the SPEA on the ground

Prior to construction commencing and for subsequent monitoring, the appropriate SPEA width must be located on the ground. For the Simple Assessment the SPEA width is measured perpendicularly from the **top of bank** unless the stream is located within a ravine in which case the SPEA is measured from the **top of ravine bank**. The SPEA width is always measured by horizontal distance. The definition of **top of ravine bank** is found in section 1(1) of the regulation.

2.5.4.1 Top of Bank

The top of the bank (TOB) needs to be determined as the starting point for measuring the SPEA. Where stream channels and their banks are distinct, this may be straightforward. In flatter areas, identifying the TOB based on riparian vegetation in the active floodplain can be more challenging. The TOB should be identified and flagged by a BCLS.

The TOB is defined as

1. The point closest to the boundary of the active floodplain of a stream where a break in the slope of the land occurs such that the grade beyond the break is flatter than 3:1 at any point for a minimum distance of 15 meters[1] measured perpendicularly from the break, and
2. For a floodplain area not contained in a ravine, the edge of the active floodplain of a stream where the slope of the land beyond the edge is flatter than 3:1 at any point for a minimum distance of 15 meters measured perpendicularly from the edge.

On streams located within ravines, it is important to locate the top of ravine bank, as the SPEA width is measured from where the slope breaks (becomes less than 3:1). For ravines that are greater than 60 m in width (from the top of one ravine bank to the other, excluding the wetted stream width), the SPEA is established by measuring 10 m from the top of ravine bank. Streams that are in ravines of lesser width receive a SPEA width as per the Table 2-2, measured from the top of the ravine bank. A ravine must have two steep sides; a steep slope on only one side does not qualify as a ravine. The ravine scenarios can not be applied to lakes and wetlands.

[1] Any slope change greater than 3:1 must result in greater than a 1.0 meter elevation gain between the points where the slope is less than 3:1.

3.0 Conducting a Detailed Assessment

The Detailed Assessment establishes the SPEA by determining *Zones of Sensitivity* for the Features, Functions and Conditions (FFCs) of the riparian assessment area using a series of measurements. The SPEA width is equal to the largest Zone of Sensitivity resulting from the individual assessments. In the detailed assessment the QEP also provides **Measures** to protect the integrity of the SPEA and applies them both within and, as applicable beyond the SPEA boundary. Figure 3-1 illustrates this concept.

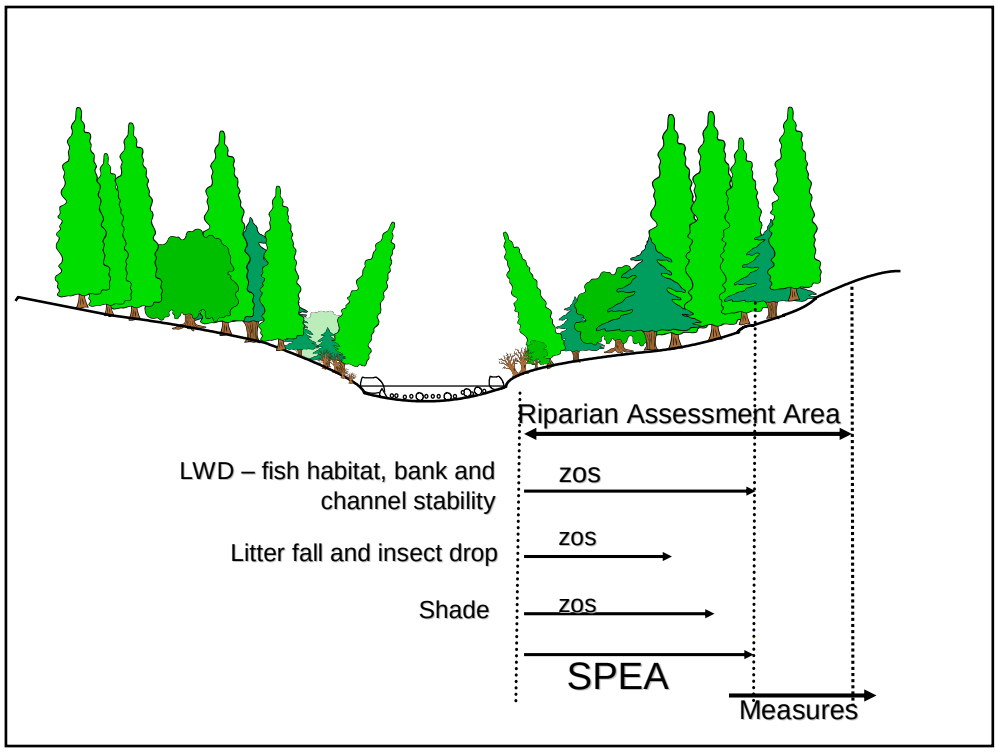


Figure 3-1. Illustration of the Riparian Assessment Area, Zones of Sensitivity (ZOS), Stream Protection and Enhancement Area (SPEA) and Measures under the Detailed Assessment.

The five main FFCs that this assessment addresses are as follows:

1. Large Woody Debris (LWD) for fish habitat and the maintenance of channel morphology
2. Area for localized bank stability
3. Area for channel movement (larger floodplains will be addressed through Measures)
4. Shade
5. Litter fall and insect drop

All of the assessments and measurements outlined below are carried out for streams, while only some are required for lakes and wetlands. It is recognized that lakes and wetlands perform different functions (e.g. biogeochemical relating to improving water quality, hydrologic related to maintaining the water regime) than streams; however, the

focus of the Riparian Areas Regulation is on riparian vegetation and its functional role in maintaining fish habitat.

To establish the ZOS for the five main FFCs the QEP determines the following:

1. Reach breaks (streams only)
2. Average channel width (streams only)
3. Average channel slope (streams only)
4. Channel Type (streams only)
5. Site Potential Vegetation Type (streams, lakes and wetlands)

Once the ZOSs and resulting SPEA(s) have been determined the QEP must then consider **Measures** to protect the integrity of the SPEA. These measures are outlined in Section 3.7. QEPs must evaluate which of these concerns exist on the site and to bring in additional expertise where required. This is a required section of the Detailed Assessment.

3.1 Step 1 Determining Reach Breaks

The basic unit employed to determine the ZOS for a stream is the stream reach. For small developments, given that a reach has a minimum length of 100 meters, it is likely that the stream associated with the subject parcel will contain one homogeneous reach. However, the QEP must verify that the stream conditions associated with the subject parcel are homogeneous enough to classify the associated stream as one reach and that a reach break does not occur within or adjacent to the subject parcel.

Streams may consist of a single reach, but more commonly are composed of a sequence of different reaches extending from the headwaters to the stream mouth. A reach is defined as a length of a watercourse having similar channel morphology, channel dimension and slope. For this purpose, the identifiable features characterizing channel morphology are the presence or absence of a continuous channel bed plus evidence of either scour or mineral alluvial deposits. The minimum length of a reach (to warrant reach breaks) must be greater than 100 m to prevent the division of streams into unmanageably small portions that may be little more than individual habitat units such as riffles, pools or glides.

Uniform channel morphology, channel dimension (and thus width and discharge), and slope are primary attributes of reaches that encompass a number of component physical characteristics including channel pattern, confinement, and streambed and streambank materials. Together, these features are used to identify reach types in the field for the purpose of the regulation.

Reaches do not change gradually or along a continuum of features. Reaches are distinct and changes occur at clearly identifiable boundaries which occur at any of the following locations:

1. where the watercourse ceases to have a continuous channel bed;
2. where a major change in channel morphology occurs, for example, as from a single channel to braided, multiple channels, or from a confined canyon to a wide floodplain, or from one channel morphological type to another (i.e. riffle-pool to cascade pool);
3. where the change in mean channel width is abrupt, for example, at the junctions with major tributaries, from a canyon to an unconfined channel, or where a major change in channel morphology type occurs;
4. where changes occur in the size and composition of streambed or streambank materials (in association with the changes in slope, discharge, and morphology type), and
5. where natural barriers to fish distribution occur and no fish occur upstream of the barrier (e.g., known from existing inventories or proven by the methodology outlined in Appendix 3.).

QEPs should note that **c**ulverts and other artificial features that have become barriers to fish passage are not necessarily reach breaks – it is important to consider whether the channel features change upstream and downstream of the feature. Each reach must be given a unique number on the site plan.

3.2 Step 2 Measuring Channel Width

The *average channel width* is used in the Detailed Assessment to determine the various Zones of Sensitivity and ultimately the SPEA width. It is not used for ZOS and SPEA determination in lakes and wetlands. It must be determined for all reaches within the subject parcel.

For the purposes of determining average channel width and bank-full width under this methodology, the following definitions apply:

Average channel width is the horizontal distance between the stream-banks on opposite sides of the stream measured at right angles to the general orientation of the banks. The border from which the width is measured is the normal bank-full width.

Bank-full width for streams means where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed and banks of the stream a character distinct from that of its banks, in vegetation, as well in the nature of the soil itself.

The point on each bank from which width is measured is usually indicated by a definite change in vegetation and sediment texture. This border is the "normal" bank-full width of the stream and is sometimes shown by the edges of rooted terrestrial vegetation. Above this border, the soils and terrestrial plants appear undisturbed by recent stream erosion. Below this border, the banks typically show signs of both scouring and sediment deposition. While the definition for **bank-full width** is very similar to the definition for **high water mark** in the RAPR, **bank-full width** does not include the active flood plain

(**for the purposes of the RAPR, defined as the Stream Boundary**). In some low gradient channel types the active flood plain will extend past the edge of rooted vegetation, and the high water mark will extend past the bank- full width.

In the case of highly-modified channels where natural indicators are not present to determine bank-full width the methodology outlined in section 3.6.5 should be followed. QEPs should recognize that some species of vegetation are tolerant to moderate flow velocities and may be established below the bank-full width. In these instances additional indicators such as rafted debris should be used to determine the location of the bank-full width.

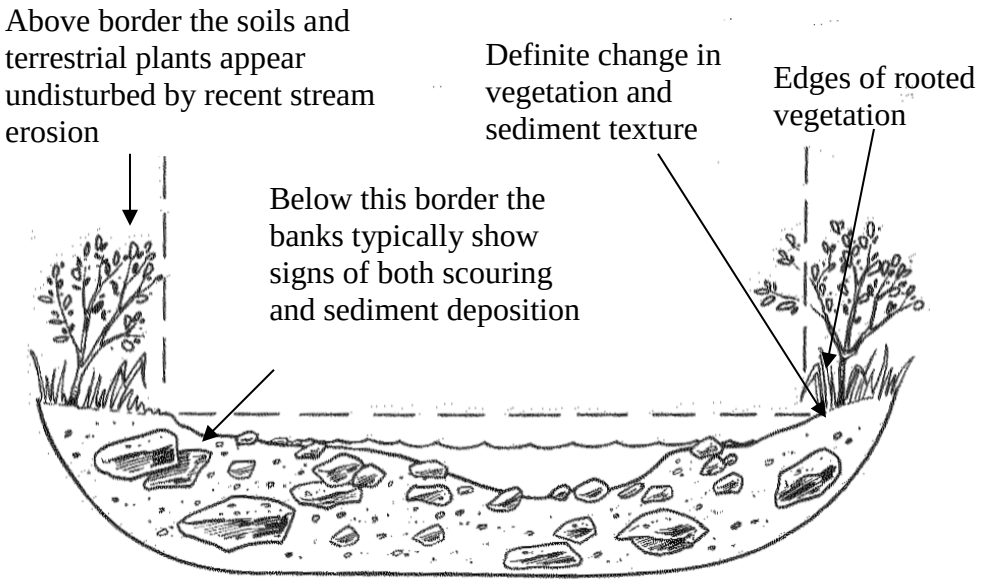


Figure 3-2. Indicators of Bank-full Width for Streams

Stream width measurements should not be made near stream crossings, at unusually wide or narrow points, or in areas of atypically low slope such as marshy or swampy areas, beaver ponds or other impoundments. Avoid measuring channel width in disturbed areas unless the entire reach is in altered state. "Normal" channel widths can be increased greatly by both natural and human-caused disturbances.

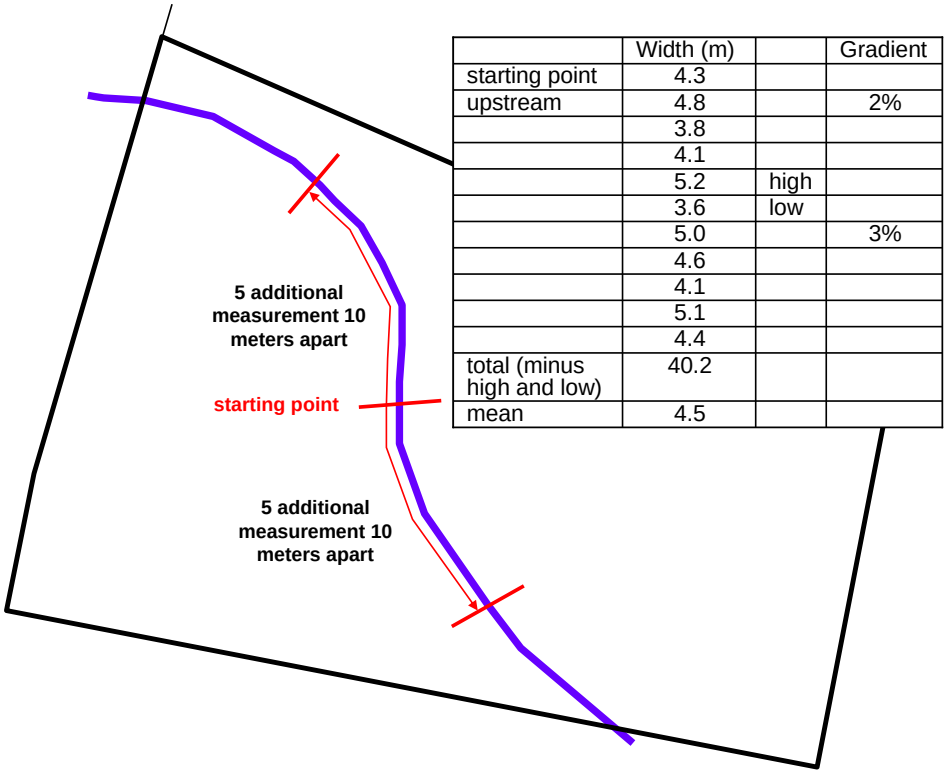
To determine the mean reach width of a stream channel:

a) Include all unvegetated gravel bars in the measurement (these usually show signs of recent scouring or deposition). Gravel bars with herbaceous stems or grasses that are tolerant of periodic high water should be considered unvegetated.

b) Where multiple channels are separated by one or more vegetated islands (having woody stems), the width is the sum of all the separate channel widths. The islands are excluded from the measurement.

c) The average width of the stream reach is calculated by taking a total of eleven separate width measurements spaced 10 m apart. The starting point for the measurements is the

center of the reach within the subject parcel as shown in Figure 3-3. The lowest and highest measurement is then discarded and the remaining 9 measurements are averaged. In reaches where a full set of measurements is not feasible due to site constraints, a thorough explanation is required as to why fewer measurements are adequate to describe reach characteristics. Justification for deviation from this standard may include but are not limited to: limited reach length, safe access concerns, or human-caused disturbances etc,



	Width (m)		Gradient
starting point	4.3		
upstream	4.8		2%
	3.8		
	4.1		
	5.2	high	
	3.6	low	
	5.0		3%
	4.6		
	4.1		
	5.1		
	4.4		
total (minus high and low)	40.2		
mean	4.5		

Figure 3-3: Calculating average channel width and channel slope

3.3 Step 3 Measuring Stream Slope

Average slope is calculated by taking two measurements using a clinometer or similar calibrated measuring equipment. Slope is measured between the starting point and the furthest point upstream and the furthest point downstream that channel width is measured. If these points are not visible from each other, then the nearest visible point upstream and downstream from the starting point is used. For large scale projects, it may be feasible to calculate slope based on available geomatics tools, however, its use is cautioned where external information may not be sufficiently accurate to describe specific reach characteristics.

3.4 Step 4 Determining Channel Type

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	n/a	Each reach
Required for	Streams	
Default:	Riffle-pool	
ZOS	LWD, bank and channel stability	

Channel type is used in determining the ZOS LWD (fish habitat and the maintenance of channel morphology) and bank and channel stability, for streams. For the purposes of this methodology, there are three channel types possible – riffle-pool, cascade-pool and step-pool. These three channel morphologies are relatively easy to distinguish in undisturbed channels but it becomes more difficult to determine channel types when some form of disturbance is at play, i.e. changes in streamflow discharge and sediment/debris loads. This is often the case with urban streams that have been altered or disturbed. Figure 3-4 is to be used to determine channel type using a surrogate for stream power (channel width and slope) in these situations, and can be used to confirm the channel type in less disturbed channels. **Stream calculations resulting in a point falling on the line must default to the lower channel type** (i.e. line between pool-riffle and cascade-pool defaults to pool-riffle). Small anomalies in channel type within a reach (e.g. a small Cascade-Pool section in a Riffle-Pool reach) should simply be given the same classification of the overall reach. Alluvial fans are discussed under "measures" in section in 3.7.

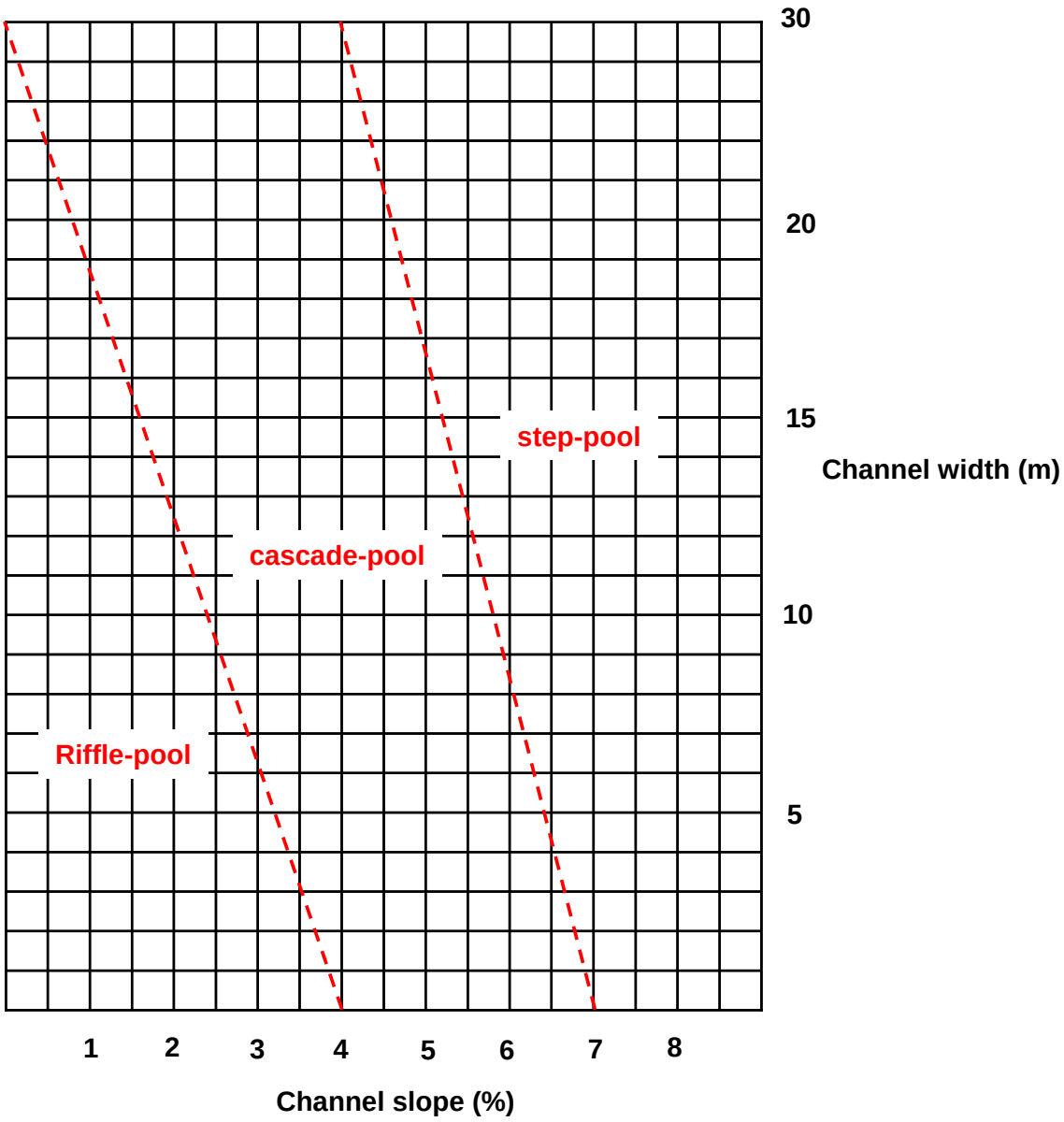


Figure 3-4: Determining Channel type

3.5 Step 5 Determining Site Potential Vegetation Type (SPVT)

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	30 m	Subject parcel
Required for	Streams, Lakes and Wetlands	
Default:	Deciduous or Coniferous Cover (TR)	
ZOS	all	

Determining the site potential vegetation type (SPVT) relates to the *capability* (potential) of the vegetation versus the *suitability* (current) of the vegetation. Table 3-1 outlines the three major categories for SPVT. These SPVTs are used to determine the Zone of Sensitivity for the various features, functions and conditions later in the assessment. The SPVT categories are based on approximate vegetation heights. LC has a height of approximately 1 metre and does not include woody stemmed plants, SH includes woody stemmed plants up to a height of 5 metres and any vegetation that reaches a height of greater than 5 metres should be considered TR.

It is important to remember that the default SPVT is TR. If a QEP ascertains a SPVT other than TR is applicable, five approaches are presented below that can be used to support this determination. The first approach is preferred, being rigorous and sufficient in justifying an alternate SPVT. The other approaches are much less rigorous and the QEP may not exercise due diligence in meeting standards in relying on only one of the other approaches in isolation. The QEP must document in the Assessment Report the approach used to determine an SPVT that is not TR.

1. Provincial ministry field guides for site identification and interpretation in forest regions
2. Adjacent undisturbed riparian areas with similar ecological characteristics
3. Historical air photographs
4. Vegetation and/or soils mapping
5. Local vegetation ecologists

Site Potential Vegetation Type (SPVT)	*Vegetation Code*
Low ground cover (i.e. grass/sedge)	LC
Deciduous or coniferous Shrub	SH
Deciduous or coniferous Tree	TR

Table 3-1: **Site Potential Vegetation Type**

Some riparian sites may have an SPVT of SH or LC due to some form of natural disturbance or limitation. Large bedrock outcrops may be identified as LC if they do not support any significant vegetation. In determining the SPVT around a wetland or lake it is important to first identify the outer edge of the wetland or lake (see Section 3.8) and then map the SPVT immediately beyond that boundary.

It is important to remember that the SPVT is the **future potential** for the site and that existing human impacts do not influence the outcome. Sites where cattle grazing or landscaping have limited vegetation to grasses do not arrive at a LC SPVT unless, if left to recover, they would never achieve a SH or TR type. Sites that contain a tree layer must be considered TR even if trees are sporadic (e.g. the Ponderosa pine Biogeoclimatic Zone (BGC) generally demonstrates an open parkland with a Ponderosa pine canopy) and consideration must be given to the type of vegetation typical in a riparian area (e.g. in the Bunchgrass BGC riparian sites tend to include shrubs so they should not be classified as LC).

3.5.1 Creating Polygons for SPVTs

Larger, more diverse sites may warrant stratifying into smaller homogeneous units. If the QEP wishes to stratify the site into polygons of various SPVTs, then the following methodology should be undertaken. The polygon should meet the minimum polygon size outlined in step 2 below and illustrated in Figure 3-4. Different Zones of Sensitivity may have to be calculated for each polygon with a different SPVT. This may ultimately result in a variable width SPEA within the development.

Using air photos or ground surveys stratify the area into the various polygons of uniform vegetation. The site plan map produced for the development can be used as base map and the SPVT polygons shown as an overlay. Polygons identified through air photos should be ground-truthed.

1. The minimum length of the radius from the geometric center of a polygon should be 15 m (see Figure 3-5).
2. The vegetation polygon must contain no more than 20% of another (or combination of) SPVT by area. Any polygon with a TR component must be treated as TR for the purposes of establishing the Zones of Sensitivity.

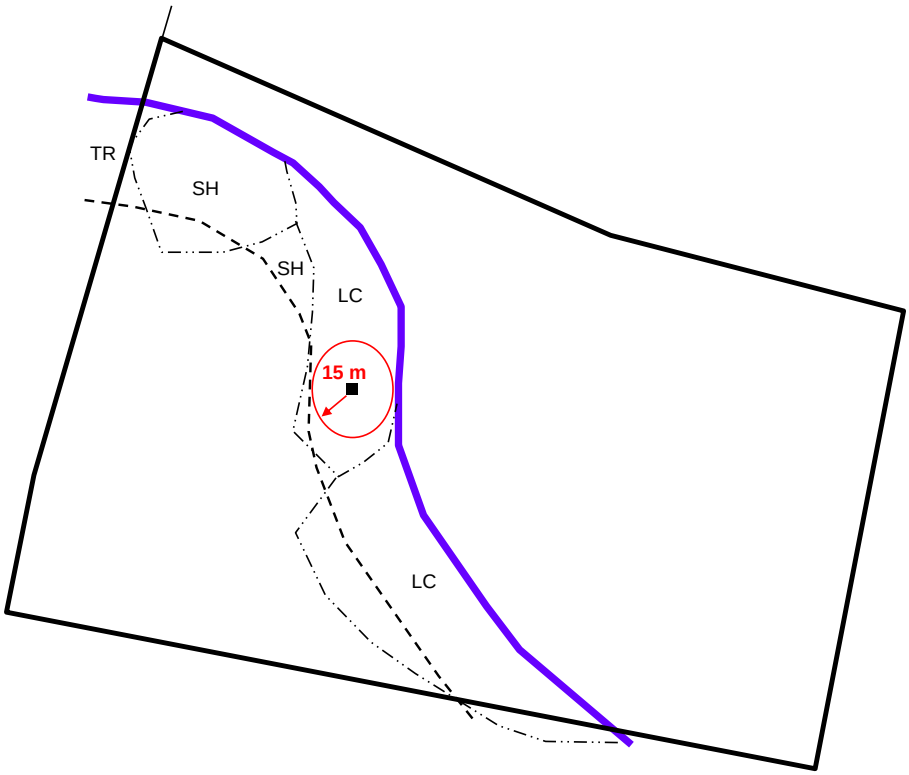


Figure 3-5: Creating Vegetation Polygons

3. Once the polygons are established lines are drawn at right angles to separate the individual polygons in segments as shown in Figure 3-6.
4. Each segment must be given a unique number for recording on the Assessment Report. In the event that a reach break occurs within a vegetation segment the reach break should be moved to the nearest segment boundary in the direction of the wider average channel width.
5. Each of the segments created by the lines is then labeled and given an overall SPVT, defaulting to the SPVT that has the highest potential height, i.e. if there is a SH component along with a LC then the segment gets a SH designation. This is illustrated in Figure 3-6

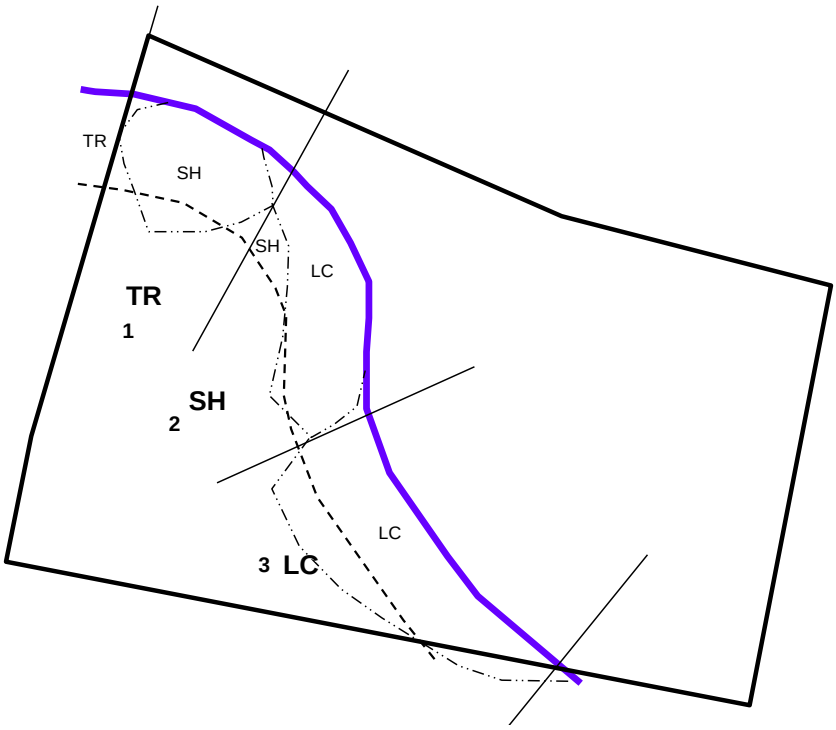


Figure 3-6: Overall SPVT segment designations

3.6 Determining the Zones of Sensitivity

This methodology involves determining three Zones of Sensitivity (ZOS) for the following features functions and conditions of riparian areas.

1. Large Woody Debris (LWD) for fish habitat and the maintenance of channel morphology
2. Area for localized bank stability
3. Area for channel movement
4. Shade
5. Litter fall and insect drop

The first three have been combined as they are related to an individual morphological channel type. The ZOS for the remaining two will be derived at separately.

3.6.1 Large Woody Debris, Bank and Channel Stability for Streams

Table 3-2: Zone of sensitivity for channel and bank stability based on channel type, Channel width, and SPVT

	SPVT		
Channel Type	***LC***	***SH***	***TR***
Riffle-pool	3 times channel width		
	max. of 5 m	max. of 20 m	max. of 30 m (min of 10 m)
Cascade-pool	2 times channel width		
	max. of 5 m	max. of 10 m	max. of 15 m (min of 10 m)
Step-pool	1 times channel width		
	max. of 5 m	max. of 10 m	10 m

In using table 3-2 first multiply the channel width determined in **Step 2** (Section 3.2) by the appropriate factor for the channel type determined in **Step 4** (Section 3.4) and the SPVT determined in **Step 5** (Section 3.5) and then adjust based on the minimums and maximums identified for each category. For wide streams with a channel width greater than those captured in Figure 3-4 a conservative approach should be employed to determine stream type and resultant ZOS. **In addition, for TR SPVT types natural landslide areas that are coupled to the stream and are within the RAA are obvious sources of large wood that are not captured by the ZOS for LWD in the above table. The QEP must assess whether any of the slope stability triggers identified in the slope stability measures assessment are present within the RAA. If slope stability triggers are present a slope stability measure assessment must be conducted to determine if there are any unstable slopes linked to the stream channel. These linked unstable areas are then to be included within the LWD ZOS and the resultant SPEA, and slope stability measures developed to ensure the development does not destabilize the slope and put the integrity of the SPEA at risk.**

Figure 3-7 shows an example ZOS for a Cascade-pool channel type with a SPVT of TR. This example has a channel width of 6.2 m and a resulting ZOS for LWD, bank and channel stability of 12.4 m.

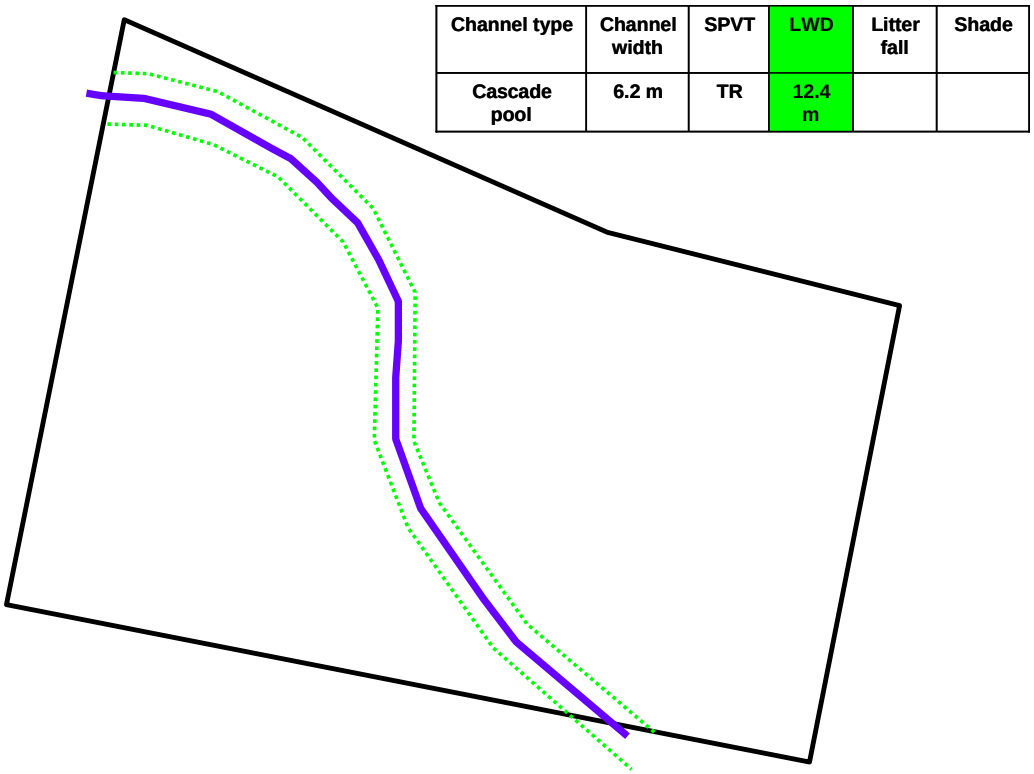


Figure 3-7: Layout of LWD, bank and channel stability ZOS

3.6.1.1 Large Woody Debris for Lakes and Wetlands

The riparian zone of lakes and wetlands often contains large wood which provides important cover when it falls into the water, providing protection for smaller species, fry and juvenile fish. Because their decay rates are slow, especially for conifer species, fallen trunks can provide habitat structure over a long period of time. Further, the vegetation within the riparian zone of a lake provides natural protection from erosion. The riparian zone adjacent to small lakes and wetlands is particularly important, where it may be the only source of LWD. The streams that enter these features do not have the power to move LWD to the feature itself. Foreshore fish habitat in lakes and wetlands often suffers when riparian owners remove aquatic vegetation for pier construction, boat access, swimming, or aesthetic reasons.

The LWD ZOS for lakes and wetland (Table 3-3) is therefore related to the height of the site potential vegetation type. Although both LC and SH contribute little if any LWD to a lake or wetland, a minimum width is provided for bank protection.

SPVT	*Zone of Sensitivity*
LC	5 m
SH	5 m
TR	15 m

Table 3-3: Lakes and Wetlands ZOS to provide LWD and bank stability

3.6.2 Litter Fall and Insect Drop for Streams, Wetlands and Lakes

The ZOS for litter fall and insect drop is determined by the Site Potential Vegetation Type determined in **Step 5** and the size of the stream or wetland.

SPVT	*Zone of Sensitivity*	*Streams*		*Lakes and Wetlands*
		Min.	*Max.*	
LC	5 m	5 m	5 m	5 m
SH	2 x width	5 m	15 m	10
TR	3 x width	10 m	15 m	15

Table 3-4: Determination of Zone of Sensitivity for Litter fall and Insect Drop for streams, lakes and wetlands

Figure 3-8 illustrates the ZOS for the previous example of a Cascade-pool channel type with a SPVT of TR. Here the ZOS for litter fall and insect drop would be 3 times the channel width to a maximum of 15 m, or in this specific case 15 m.

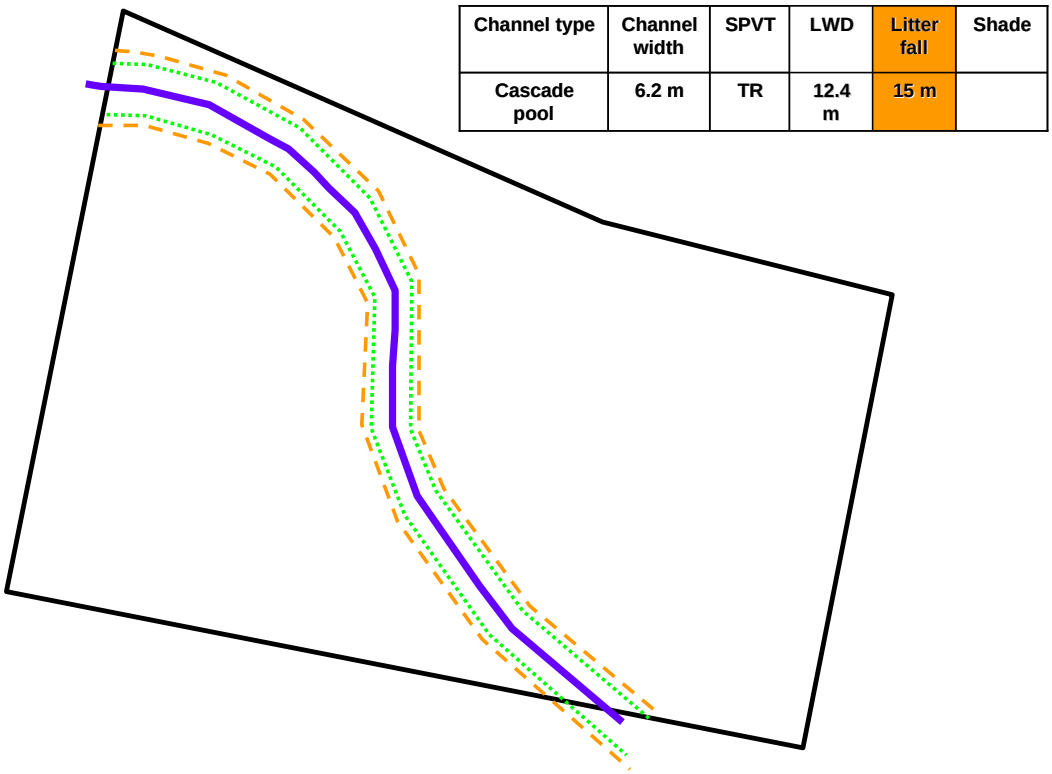


Figure 3-8: ZOS for Litter Fall and Insect Drop

3.6.3 Shade for Streams, Lakes and Wetlands

The **relative** ability of vegetation to influence stream temperature (shade) depends on many factors, such as quality of shade, angle of sun, degree of cloud cover, leaf angle, aspect and orientation of watershed, time of year, stream volume, volume of subsurface flows, width and depth of water column, and height, density and species of vegetation.

Solar angle, geographic stream orientation, stream width, the surface-to-volume ratio (width-to-depth ratio) of the stream and the height of the natural vegetation are all factors that determine the importance of shade to a particular stream reach. The following methodology has been adapted from using solar angle, stream aspect and the height of the natural vegetation to calculate the width of riparian buffer required to maintain shading to the stream.

The first step is to open a layout file in an appropriate mapping or drawing program and place a line on top of the high water mark of the subject stream. To establish the zone of sensitivity for shade for streams with a SPVT of TR the line is dragged 3X the channel width (to a max of 30 meters) **due south**. For streams with a SPVT of SH the multiplier is 2X to a max of 5 meters. As LC does not provide shade no ZOS is calculated. The respective shift for each feature is shown on Table 3-5.

It is important to note that for temperature sensitive streams where designated by the province, the width modifier is not used and the maximum distance based on the SPVT is employed for the south bank.

SPVT	*Streams*	*Wetlands, Lakes*
LC	n/a	n/a
SH	2 x width (max 5 m)	5
TR	3 x width (max 30 m)	30

Table 3-5: Zone of Sensitivity for Shade for Streams, Lakes and Wetlands

Figure 3-9 shows the ZOS calculation for shade on a stream with a SPVT of TR. As the example illustrates a riparian area with a ZOS of TR the multiplier is 3X so the overlaid line is dragged 18.6 m south since the channel type is Cascade Pool.

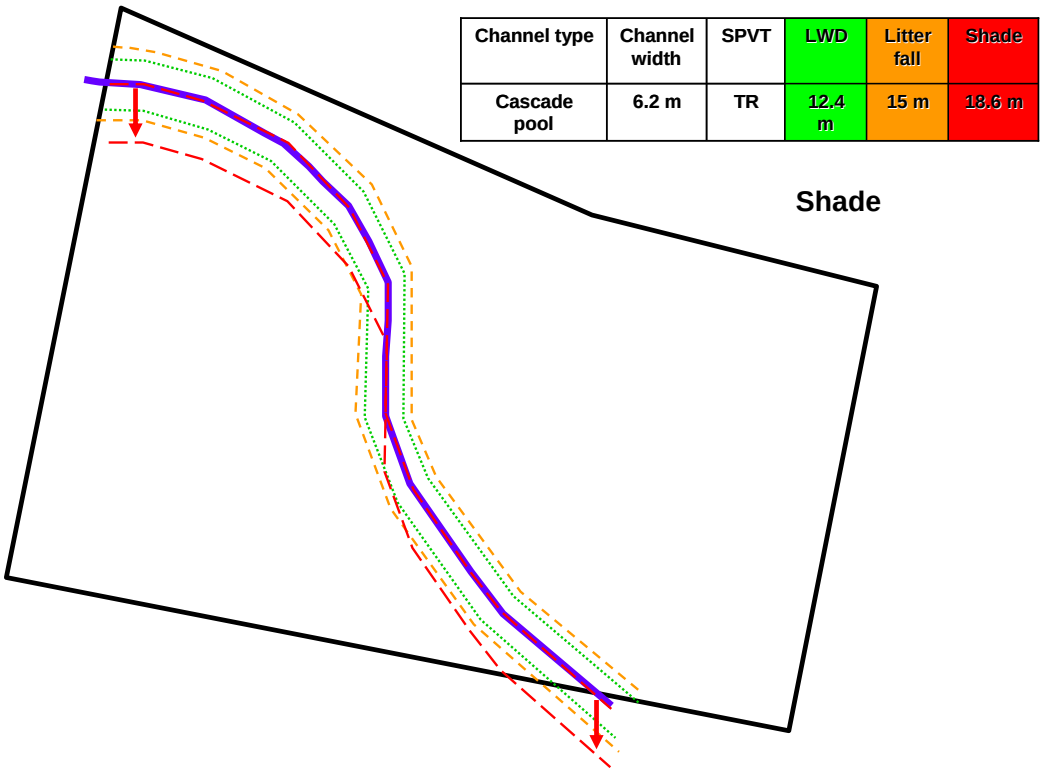


Figure 3-9: Zones of Sensitivity for Shade

3.6.4 Calculating the SPEA Width using the Detailed Assessment

Once all the Zones of Sensitivity have been calculated the SPEA is determined by **using the widest ZOS**. The QEP will flag the HWM and provide a surveyor with the SPEA width(s) to be defined on the ground.

As shown in Figure 3-10, the resultant SPEA may have a width that varies based on which ZOS was widest at which point on the stream. In this example the SPEA on the south side of the stream varies between 15 m and 18.6 m in width driven by litter fall (15m) and shade (18.6 in some locations). The SPEA on the north side will be a consistent 15 meters from the HWM.

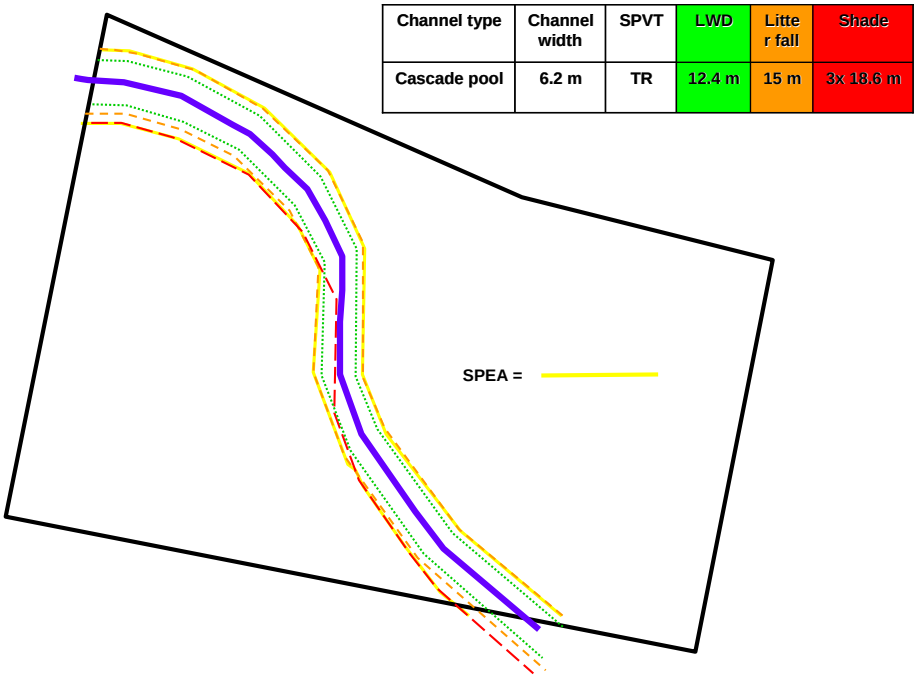


Figure 3-10: Determining the Resulting SPEA

On larger developments, riparian vegetation may be stratified into various different types (see creating polygons in section 3.5.1). This makes calculating the resultant SPEA somewhat more complex as the various ZOS are determined for each segment. Where the development encompasses both sides of a stream, then each side would be considered a separate segment. Using the example from this section, the ZOS are calculated for each segment in the same fashion as a stream with only one SPVT. The resulting SPEA is then determined by following the outermost ZOS. The QEP uses their knowledge of the site and their best judgment when the ZOS changes from one segment to another to smooth out the resulting SPEA. This is done by drawing the SPEA by linking each segment with varying ZOS by a line drawn at 45 degree as shown by the green line in Figure 3-11.

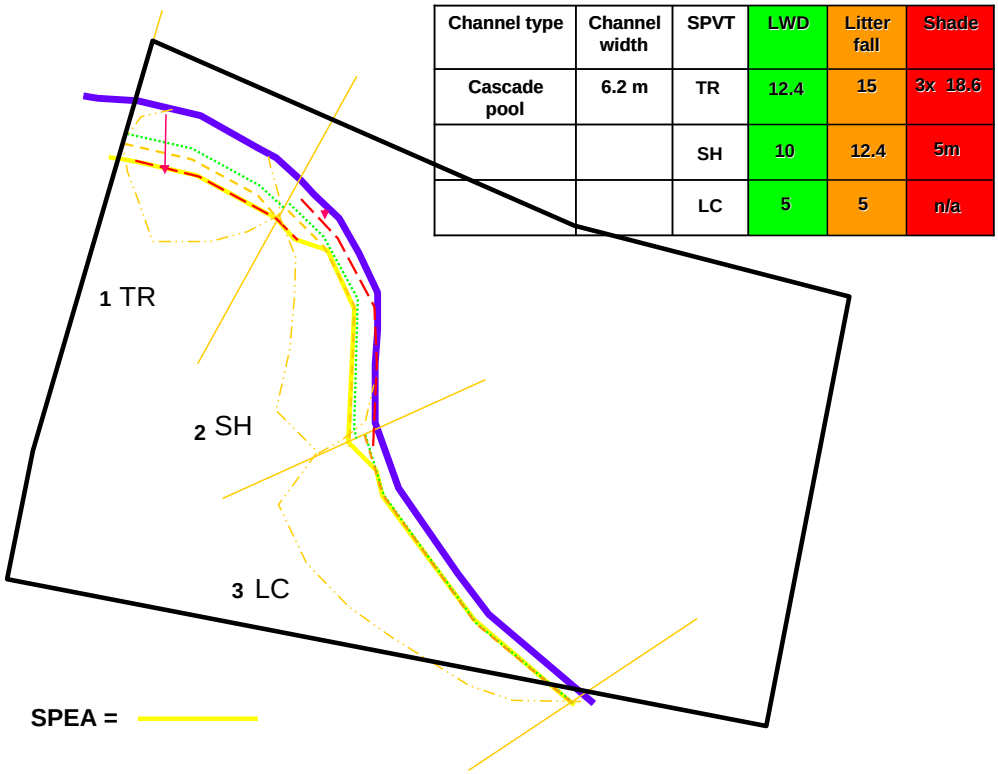


Figure 3-11: Determining the SPEA for a stream with various SPVTs

A method similar to streams is used to determine the SPEA around lakes, ponds and wetlands. The first step is to stratify the SPVT around the feature in a manner similar to streams (Figure 3-12). Next the respective ZOS for LWD and bank stability, litter fall and insect drop and shade are applied to each segment of the lake (segments are determined by SPVTs). Each segment is labeled with a unique number. The SPEA will follow the largest determined ZOS. This is illustrated in Figure 3-13.

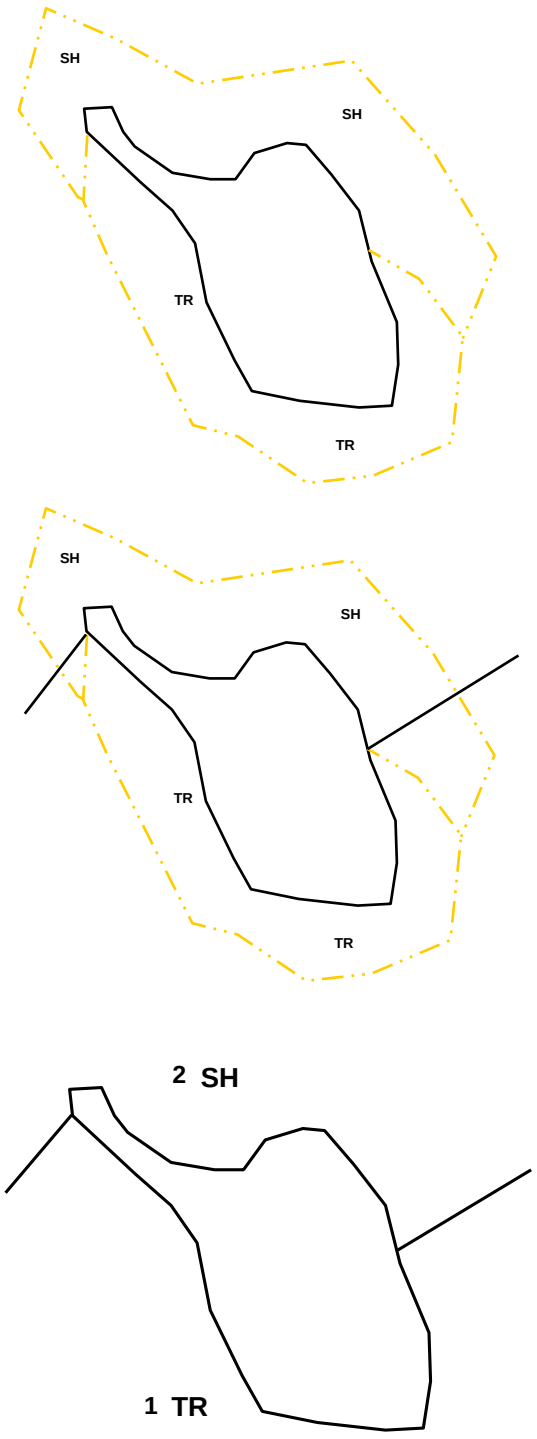


Figure 3-12: Stratify SPVT around Perimeter of Feature

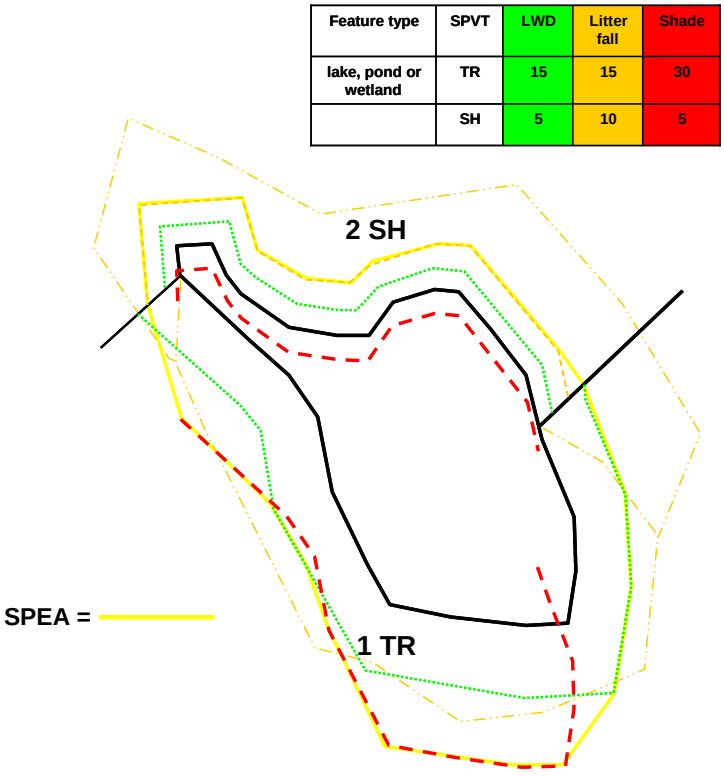


Figure 3-13: SPEA determination around Lakes, Ponds and Wetlands

3.6.5 Ditches

Where ditches are connected via surface flow to fish habitat as defined in the RAPR, they are considered *streams* under the regulation and require an assessment and SPEA determination. Ditches are characterized as being manmade and straight and are not fed by headwaters or springs. They are constructed to drain property (they often form property boundaries) or roadways and while connected to natural streams they are not part of the natural historic drainage pattern. They are often diked with regulated or seasonal flows. If a QEP is uncertain as to whether the stream they are dealing with is a ditch they should default to the classification of *stream*. Table 3-6 presents distinguishing characteristics of a ditch versus a channelized stream.

Under the Detailed Assessment, ditches receive a SPEA based on dimensions and fish-bearing status (Table 3-7). To determine the SPEA for ditches, utilize the channel width information collected in Section 3.2 and direction in Section 2.2 as to fish bearing status.

Table 3-6: Characteristics of Channelized streams and Ditches

Feature	Channelized Stream	Ditch
Distinguishing Characteristics	Flows most if not all year round. Forms part of historic natural drainage pattern. Larger intact headwaters or sources of groundwater. Depending on degree of channelization, natural segments of channel remain.	Flow is seasonal. Entirely manmade and straight with a no headwaters or springs. Often diked with regulated flows.
Large Woody Debris	Needed for fish habitat and may be needed to maintain channel morphology (as per natural channels)	Required only when fish present
Bank Stability	Depending on degree and nature of channelization, rooted vegetation may be required to maintain bank stability. However, requirement to provide for channel migration (or future restoration of) will accommodate requirement for bank stability	Depending on nature of channelization, rooted vegetation may be required to maintain bank stability
Lateral Channel Movement	Suitable area needs to provided for lateral channel stability or options maintained for restoration as per natural channels	Lateral movement is confined and stable. Often forms property or field boundary or is aligned and constrained by a permanent roadway.
Shade	Should be provided for as per natural channels	Should be provided for at slightly reduced levels
Litter fall and Insect Drop		

Table 3-7: SPEA widths for ditches

<table>
<tr><th rowspan="2">Function</th><th colspan="2">Constructed Ditch</th></tr>
<tr><th>Fish</th><th>No Fish</th></tr>
<tr><td>LWD for maintenance of channel morphology and provision of fish habitat</td><td rowspan="2">2 times channel width
max 10 m
min 5 m</td><td>n/a</td></tr>
<tr><td>Vegetation to assist in controlling localized erosion</td><td>2 m</td></tr>
<tr><td>Suitable area to allow for lateral channel movement</td><td>n/a</td><td>n/a</td></tr>
<tr><td>Litter Fall and Insect Drop</td><td rowspan="2">2 times channel width
max 10 m
min 5 m</td><td rowspan="2">2 m</td></tr>
<tr><td>Shade</td></tr>
</table>

3.6.6 Dikes

There are situations where the development is separated from the watercourse by a dike. The characteristics of the dike often determine the value of riparian areas landward of the crest of the dike to the stream. Where the dike is very high and wide, the potential value of riparian areas landward of the crest of the dike may be limited. For smaller dikes, riparian vegetation landward of the dike crest is often still interlinked with the stream and must be maintained. When dealing with this type of situation QEPs must contact the province to review whether riparian vegetation landward of the dike crest is contributing to the watercourse and the SPEA as determined by the Assessment Methods must be provided; or if the riparian vegetation landward of the dike crest is not contributing to features, functions and conditions and therefore a SPEA is not required.

3.7 Measures to protect the Integrity of the SPEA

When the Detailed Assessment is used, the QEP must consider **measures to protect the integrity of the SPEA.** QEPs are expected to evaluate where specific concerns exist on the site and to bring in additional expertise where required. Measures must provide a level of detail that takes into account that the assessment report provides direction to the landowner describing what is required to ensure SPEA protection from development, and that the measures specified may serve as requirements of a local government permit.

Explicit direction from a QEP in the Measures section serves as due diligence in the event a development is audited for compliance with the Regulation.

A description of all "Measures" (actions and contingencies) that will be taken to maintain and protect the SPEA from development outside of the SPEA must be included in the Assessment Report if the Detailed Assessment is used. The measures that must be considered include: assessment and treatment of danger trees, windthrow, slope stability, tree protection during construction, encroachment and sediment and erosion control. The only measure permitted within the SPEA is the treatment of hazard trees as identified by a QEP who has provincial danger tree assessment training. Some measures will result in areas beyond the SPEA being identified as areas requiring special protection or limited activity. For example, addressing windthrow may require the creation of a windfirm buffer outside of the SPEA. Local governments may include bylaws that outline specifications around measures included in a report. Site maps must reflect measures to be incorporated.

Addressing some of these measures may require retaining other QEPs with specialized expertise and/or skill sets. Not all sites will require an assessment for all measures; the primary QEP is responsible for identifying if the site conditions indicate a particular problem or issue. For example, where the watercourse is in a ravine the primary QEP should seek advice from a geotechnical engineer on slope stability measures required to prevent any failure of the ravine slope both during and post-development. It is very important that QEPs provide advice only within their area of expertise.

At the subdivision stage, where development plans are not yet finalized, measures to protect the SPEA should be revised as necessary throughout the subdivision review process. Based on the degree of development proposed at the subdivision stage measures can include but are not limited to; Tree protection and windthrow concerns, Erosion protection and stormwater management from servicing or access, and follow-up procedures or reporting required in advance of development planning. It should be recognized that the preliminary assessment at the subdivision stage may provide a SPEA width but that the measures may require several revisions to provide appropriate guidance on the development at subsequent approval stages.

3.7.1 Addressing Danger Trees in the SPEA

Danger trees located within the SPEA should be assessed by a QEP with appropriate training to determine if they pose a high risk to the adjacent development. To determine whether to remove a danger tree, an assessment should be completed by a qualified professional who is a qualified provincial danger tree assessor. If a tree is determined to be unsafe, there are options available to reduce or eliminate the threat to safety. Trees felled within a SPEA are to be left as coarse woody debris and should be replaced according to the provincial tree replacement criteria. The Wildlife Danger Tree Assessor's Course: Parks and Recreation Module outlines the standards of conducting a danger tree assessment, however, this does not cover the entirety of tree species and defects experienced within an urban environment. A training course is available through the Pacific Northwest Chapter of the International Society of Aboriculture on Tree Risk Assessment in Urban Areas and the Urban/Rural Interface. Membership in the ISA is not

considered qualification as a QEP under the RAPR but some individuals may have both membership in the ISA and a professional designation that is recognized under the regulation.

3.7.2 Windthrow

Windthrow can be an issue where new developments remove part of a forest, leaving the remaining trees more exposed to high velocity winds. Wind damage can break tree trunks near the top or the base of the tree or uproot them. Windthrow is an issue because it places people and property in danger as well as removing riparian vegetation important to streams. In situations where forest clearing may result in windthrow developers are advised to retain the services of a professional forester. An RPF will be able to assess the windthrow hazard of the trees on the property using current professional standards of practice. Stable falling boundaries and feathering must be performed to preserve trees in the SPEA and should not be undertaken within it if the integrity of the SPEA is compromised.

3.7.3 Slope stability

One of the major areas of concern that a QEP must address is the issue of slope stability, within and adjacent to the SPEA. Measures must be developed to address slope stability concerns that may have an impact on the SPEA. Table 3.8 contains a list of field indicators that would suggest slope stability concerns. Developing appropriate measures to address slope stability will involve consulting a geotechnical engineer if the primary QEP involved lacks the necessary skills. It is important to remember that each QEP must sign off each particular area of the Assessment Report for which they were responsible.

For example, where the watercourse is in a ravine the primary QEP should seek advice from a secondary QEP who is a geotechnical engineer on slope stability measures required to prevent any failure of the ravine slope both during and post-development. If a property requires structural intervention to ensure the integrity of the slope is not compromised, a geotechnical engineer must provide justification and prescription for design and location if the proposed structure is to be located in a SPEA.

Table 3-8 Slope Instability Indicators

Field indicators	Potential landslide type
• recent landslide scars • revegetated landslide scars • old bank protection works	high likelihood of landslides of the same type and size
• partially revegetated strips (may also be snow avalanche tracks) • jack-strawed trees (trees tilted in various directions) • linear strips of even-aged timber • landslide debris piled on lower slopes • soil and rocks piled on the upslope side of trees • curved or sweeping trees (may also indicate snow creep) • mixed or buried soil profiles • poorly developed soils relative to other comparable slopes • tension fractures • poorly drained or gullied, fine-textured materials <3 m deep on slopes >50% • poorly drained or gullied coarse-textured materials on slopes >50% • wet site vegetation on slopes >50% • shallow, linear depressions • shallow, wet, organic soils on slopes >40%	debris avalanches debris flows Debris slides
• recently scoured gullies* • exposed soil on gully sides* • debris piles at the mouths of gullies* • vegetation in gully much younger than the adjacent forest • poorly developed soils on gully sides relative to adjacent slopes (repeated shallow failures continually remove the developed soil profile)	debris flows Debris slides
• tension fractures • curved depressions • numerous springs at toe of slope, sag ponds • step-like benches or small scarps • bulges in road • displaced stream channels • jack-strawed trees (trees tilted in various directions), split trees • poorly drained medium- to fine-textured materials (e.g., till, lacustrine, marine and some glaciofluvial deposits) >3 m deep • mixed or buried soil profiles • ridged marine deposits	slumps
• talus or scattered boulders at base of slope • steeply dipping, bedrock discontinuities (bedding planes, joints or fracture surfaces, faults) that parallel the slope • bedrock joint or fracture surface intersections that dip steeply out of the slope	rock slides or rock fall (can be induced by excavation and blasting for roads)

3.7.4 Protection of Trees in the SPEA

Homes constructed near riparian areas have the advantage of the aesthetic and environmental values of large trees. However, trees can become a concern in residential settings where they may endanger people and property if they are considered "hazardous".

In residential settings the most common causes of hazardous trees is damage that occurs during site clearing and construction. Severing of roots, changing the grade of the ground, and other root zone incursions often lead to the decline and death of mature trees. Construction can injure the tree branches, tear bark, and/or wound the trunk of the tree. Digging and trenching can often sever a portion of the roots. Roots of a mature tree typically extend from 1-3 times the height of the tree from the tree's trunk (i.e. far beyond the drip line). A common misconception is that trees have deep taproots - most trees do not. The majority of the roots are found within the upper 12-15 inches of the soil. Physical injury of the structural roots increases the risk of complete tree failure. Roots are also critical in anchoring a tree; if they are cut on one side of the tree the tree may fall or blow over.

Heavy equipment used in construction will compact the soil and can inhibit root growth and decrease oxygen in the soil that is essential to the growth and function of roots.

Construction activities to be avoided for protection of trees in the SPEA:

- Do not trench through the root zone of a tree
- Do not pave around trees
- Do not change the ground level around the tree
- Do not allow any parking under trees
- Do not allow concrete washout or other pollutants to contaminate the soil around trees

Construction best practices for Protection of Trees in the SPEA:

- A physical barrier should be erected to protect trees. The location of this barrier will vary based on the size and location of the trees on the site but it should provide for the majority of the tree's root system to be undisturbed by the construction activities.
- Communicate tree protection plans to everyone involved in the project. Write damage clauses into any service contract to provide financial penalties to any contractors who damage trees.
- Monitor the impacts of construction activities. If roots have been cut make sure they weren't shattered by a backhoe or other equipment. Broken roots should be cut cleanly with a saw.
- Mulch about the base of trees to retain moisture.

- Vertical mulching may be necessary where roots have been severely impacted by machinery or fill.
- Prune any broken limbs with clean cuts.
- It is strongly recommended that a QEP with specific training is retained to provide advice on the rooting zone for SPEA trees, to oversee installation of the physical barrier, and to undertake any corrective actions required.

3.7.5 Preventing Encroachment in the SPEA

Direct human impact to streams most often consists of refuse dumping, trampling of vegetation, bank erosion and noise. Plant loss due to the trampling of vegetation near a stream increases silting of spawning gravels and reduces aquatic invertebrates that are important fish food sources.

A major cause of riparian loss and stream degradation continues to be encroachment by adjacent land owners. Easements or restrictive covenants alone are only lines on paper which have proven to be ineffective against encroachment. Visual barriers such as fences or signs appear to be the most effective tool to stop encroachment. Local governments sometimes require permanent fencing of SPEAs a mandatory element of developments by watercourses.

Fences should be installed to demarcate SPEAs for future land owners and occupiers. The height of the fence and material it is made from should be complementary to the nature of the development. High chain-link fences are be appropriate in industrial and commercial settings, low split rail fences may be functional in park settings, and medium height wooden fences may be appropriate adjacent to residential yards.

The QEP will evaluate the severity of encroachment expected on the site both during and post construction and must provide recommendations for the type of barrier that would be most effective to the situation.

3.7.6 Sediment and Erosion control during Construction

As part of the site design, a sediment and erosion control plan should be developed to prevent the discharge of sediment laden water into the SPEA or any watercourse. The SPEA should not be used to filter sediment laden water prior to discharging into a watercourse and SPEA widths were not designed for this function. The QEP is responsible for implementing a sediment and erosion control plan and for monitoring the installation, effectiveness and maintenance of its components. The QEP is responsible for determining any local government bylaw standards for sediment and erosion control and ensuring that the assessment report takes these into consideration. At the subdivision stage, general guidance regarding site clearing may be provided with detailed plans being a requirement at the construction stage.

3.7.7 Stormwater Management

Stormwater resulting from development within the assessment area should be returned to natural hydrologic pathways. The key to runoff volume reduction and water quality improvement is capturing the small storm runoff (less than 50% of the rainfall event that occurs once per year, on average) from these rooftops and impervious surfaces. The goal is to capture runoff from rooftops, driveways, parking and other impervious areas for infiltration, vapor-transpiration and/or reuse. The RAPR is only able to address development within the Riparian Assessment Area but stormwater management is an issue for the entire development site and watershed. For all Detailed Assessments, the QEP must include in their Assessment Report a plan to capture the small storm runoff event from the Riparian Assessment Area. Stormwater Management infrastructure is not to be located in a SPEA and any discharges to streams will require meeting the Water Sustainability Act or any other applicable legislation.

The requirements identified here under the RAPR should not be considered sufficient to achieving stormwater objectives for the entire development. The provincial government document entitled *Stormwater Planning: A Guide for British* Columbia (May 2002) provides a very good reference for this topic and provides examples on how to develop measures to achieve this goal.

3.7.8 Floodplain Concerns

Flooding is a common hazard in British Columbia as a result of heavy rainfall (flash floods), snowmelt (spring freshets) or ice jams. The RAPR Detailed Assessment considers the active floodplain (**Stream Boundary**) and ensures that the SPEA starts at the edge of this feature. On very dynamic channels this may not be sufficient to protect the SPEA or the development from flood hazards and damage.

Where these issues are applicable, the QEP should identify issues related to the maintenance of the SPEA and larger floodplains and ensure that a professional, qualified in floodplain issues has been consulted. Developments occurring on large floodplains (greater than the active floodplain) and alluvial fans can result in requests for diking, bank revetment and stream channelization, all of which can negatively affect the proper functioning condition of the riparian ecosystem. The goal in any proposed changes should be to maintain the natural movement of the stream channel. Any proposed channel alterations will require approval by the province under the Water Sustainability Act and cannot be included in an RAPR Assessment Report until this approval has been obtained.

Often this issue is one that local governments have enacted Bylaws or Development Permit Areas to address. Setbacks for floodplain assessments may not align with the RAPR HWM as the purpose of where the standards are measured from do not serve the same function.

3.8 Establishing the SPEA on the Ground

Prior to construction commencing and for subsequent monitoring, the appropriate SPEA width must be located and marked on the ground.

Once all the Zones of Sensitivity have been calculated the SPEA is determined by using the widest ZOS and is measured horizontally from the edge of the High Water Mark (HWM). This boundary should be identified and flagged by a QEP before being surveyed by a land surveyor for use in site survey plans.

3.8.1 High Water Mark / Stream Boundary

The definitions of High Water Mark, Active Floodplain and Stream Boundary are found in Part 1, Division 1 of the RAPR.

On site, the high water mark is determined based on specific characteristics and should take into account the definition of **Stream Boundary** in the regulation. For flowing watercourses, it is indicated by a distinct change in vegetation and sediment texture. Above the high water mark, the soils and terrestrial plants appear undisturbed by recent stream erosion. Bank areas below the top of the bank typically have freshly moved sediment (e.g., clean sands, gravels and cobbles) and show signs of both sediment deposition and scouring. Where stream channels and their banks are distinct, this is straightforward. However, in flatter areas, identifying the high water mark based on riparian vegetation in the active floodplain can be more challenging.

Clues to identify the **Active Floodplain** for areas flooded once in five years on average include:

1. Flood periodicity (areas flooded by stream water once in five years, on average)

2. Indicators of past flood levels (channels free of terrestrial vegetation, the location of rafted debris or fluvial sediments that were recently deposited on the surface of the forest floor or suspended on trees or vegetation, or recent scarring of trees by material moved by flood waters).

For the Detailed Assessment the SPEA begins at the Stream Boundary. Remember that seasonally inundated channels (e.g. backchannels and side-channels) are included in the Active Floodplain so the SPEA starts on the outside edge of these features.

3.8.1.1 Outer Edge of Wetlands

From an ecological perspective, either an abundance of hydrophytes or hydric soil conditions is generally sufficient to indicate a wetland ecosystem. The boundary or HWM of the wetland is identified by changes in vegetation structure, loss of obligate hydrophytes, and absence of wetland soil characteristics. Please check the ministry website for publications regarding Wetlands in British Columbia.

Wetland soils are subhydric or hydric and have one or more of the following features that reflect anaerobic soil conditions:

- Peaty organic soil horizons greater than 40 cm thick
- Non-sandy soils with blue-grey gleying within 30 cm of the surface

- Sandy soils with predominant mottles within 30 cm of the surface or blue-grey matrix.
- Hydrogen sulphide (rotten egg smell) in upper 30 cm

3.8.1.2 High Water Mark for Lakes

For ungauged lakes the high water mark is where the presence and action of annual flood waters area so common and usual and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself and includes areas that are seasonally inundated by floodwaters.

Where a lake is gauged and agencies have agreed on a calculated lake level, this value may be used as the HWM. The QEP needs to ensure that this agreed level includes those areas that are seasonally inundated once in five years on average. Where natural indicators on the shoreline (e.g., change in soil, change in vegetation) show that wave action or other hydrological processes affect the shoreline to such an extent that the recommended HWM is not applicable at that site (e.g., highly exposed or sheltered sites). A site-specific HWM can only be used where the QEP has provided a technical rationale for why the recommended HWM is not applicable. The technical rationale must include photo documentation of the site shoreline with a stake or marker indicating the location of both the recommended HWM and the proposed HWM.

For reservoirs, full pool is considered the HWM.

The term “natural boundary” is used in surveys of lakeshores. The natural boundary does not always match the levels identified above for HWM for lakes and in some instances the surveys of natural boundary are out of date such that this line is below current water levels during much of the year. The definitions for HWM are provided such that a QEP can use these indicators to determine a more appropriate starting point for the SPEA on lakes.

3.8.2 Ditches

SPEAs for ditches, as determined by section 3.6.5 are laid out in the following fashion as illustrated in Figure 3-14.

1. The channel width is determined by the width of the ditch at the midpoint between the ditch invert and the top of the ditch bank
2. The SPEA setback is then outward from the top of the ditch bank

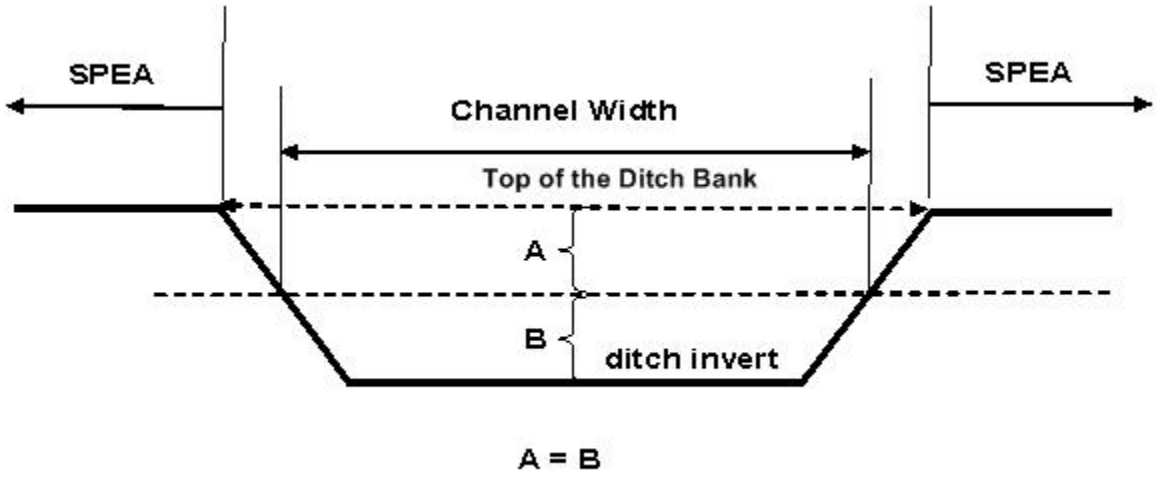


Figure 3-14: Determining Channel width for a Constructed Ditch

Appendix 1: Electronic Submission

For the current version of the:

1. The electronic notification system for filing an Assessment Report
2. The Guide for using the electronic notification system
3. Assessment Report templates *
4. Guidelines for assembling an "Assessment Report" using the templates

Refer to the BC Government website under *Riparian Areas Protection Regulation*.

* Note: An "Assessment Report" **must** utilize the report templates.

Appendix 2: Fish Sampling Methodology

One of the two alternative methods detailed below in the subsection "Acceptable survey methods." Either the *systematic-sample method* (Option 1) or the *first-fish-captured method* (Option 2) must be employed to demonstrate fish absence in reaches of < 20% slope.

Fish collection permits and the requirements discussed previously under "Qualifications and training" are also mandatory. RIC standard data forms, recording and data management are recommended but not mandatory for the purpose of determining whether or not a stream is fish-bearing.

The following protocols should be followed in order to conduct an acceptable survey to confirm the absence of fish from stream reaches if the decision has been made to undertake a fish sampling program. Fish presence can be determined by a number of acceptable techniques that cover a range of efficiency and sampling intensity. The simplest technique might be sufficient to determine fish presence. Fish presence is confirmed once an individual specimen of the appropriate species is properly identified. Sampling information and results are then recorded and kept on file.

Determination of the absence of fish from a body of water is much more difficult. While no fish may be captured at successively greater levels of sampling intensity, the ultimate "proof" of absence must be associated with the most intensive and efficient procedure appropriate for the species, life stage and time of year. For example, when sampling for quantitative purposes, baited traps are ideally set over 24 hours for juvenile fish, or two-trial electrofishing is performed. It is recognized that these levels of effort are sometimes difficult to achieve.

In order to establish absence acceptably, a reasonable balance between sampling effort and risk of error must be achieved to produce satisfactory results consistent with the intent of the regulation.

Sampling effort must include a significant portion of the stream reach and be applied in the seasons appropriate for the geographical area and habitat types present (main channel, off-channel, seasonal). The proper equipment must be used under appropriate environmental conditions. For example, electrofishing will be much less effective in cold water (i.e., < 5°C) or where electrical conductivity is low.

It is recommended that sampling be done in a systematic and repeatable way so that results can be accepted with confidence. This guidebook presents a series of sampling techniques and gear types that generally reflect intensity levels. The intent of this guidebook is ***not*** to identify electrofishing as the only acceptable and final "technique of choice," although this gear type has become singularly advocated to determine fish presence or absence for fish-stream identification. Biologists and technicians conducting fish surveys must be aware that alternative techniques and gear are available, and in many cases may be more appropriate to the habitats, environmental conditions and species present.

Ultimately, an acceptable survey has been performed when there is, in total, sufficient evidence to support the conclusion that fish do not occur in a given stream reach. The evidence must include, ***in addition to fish capture results:***

1. any known information on fish presence upstream and downstream of the reach sampled
2. type and location of obstructions to fish migrations
3. sampling conditions including stream flow, temperature and conductivity
4. sampling methods and effort (include gear selection sample timing)
5. judgment of seasonal habitat availability
6. evaluation of seasonal fish use of stream and off-channel habitats.

Evidence that justifies the designation of a stream reach as non-fish bearing is signed off by the QEP indicating the method of inventory that was used or the source of information. This brief summary may include results of any acceptable fish inventory already conducted in the watershed. It is recommended that fish sampling results and methods used be recorded in the field on standard fish collection forms. Contractors that have the capability to enter the information into the FDIS database management system are encouraged to do so. These data standards will ensure data are captured and available for future uses including the review of the stream classifications.

Sampling Techniques and Gear

Several fish sampling techniques are available including: visual sightings of readily identifiable species, angling, pole seining, trapping and electrofishing.

Visual sightings are particularly useful for surveying adult salmonids during spawning periods. The seasonal timing of surveys is critical. For example, anadromous salmon spawn most frequently from mid-July (e.g., some interior sockeye stocks) to December (e.g., some coastal coho and chum stocks). Other salmonids such as steelhead trout have different populations that collectively spawn at times that include virtually the entire year. Consult with ministry regional offices and DFO divisional offices for normal salmonid migration times and spawning periods within the region of concern.

Visual surveys conducted while snorkeling can frequently be employed in both large and small streams to locate and identify adult and juvenile fishes. Use portable lights to inspect areas frequented by stream fish such as overhanging banks, tree-root masses and logjams. Visual survey results are not appropriate to use as evidence of fish absence. Apart from viewing fish, the simplest methods are angling and trapping. These methods employ light-weight equipment and have the advantages of being relatively cheap and safe.

Angling is straightforward and effective for older juvenile fish and larger specimens. It may not be effective for catching fry. A collapsible rod which can fit in a cruiser vest is convenient gear. An angling license is required for each person who uses this method. Again, angling surveys are not appropriate to use as evidence of fish absence.

Pole seines are most effective in relatively small, shallow and slow-moving streams with relatively few obstructions. This equipment is most frequently used for collecting juvenile fishes (e.g., salmonid fry, parr and smolts). Larger, fast-swimming fish are more difficult to catch. Seining is also ineffective and difficult where water is > 1.5 m deep,

stream velocities exceed about 0.8 m/s, banks are deeply undercut, and in areas with large amounts of small organic debris, tree root masses, and tree branches embedded in the stream substrate.

Pole seines about 3 m long and 1.5 m deep are frequently employed for sampling fish in streams. For most stream work, larger nets are difficult to transport and awkward to use. Because of their disadvantages, pole seines are usually used in combination with other techniques such as electrofishing.

Before seining, use a pair of barrier nets to enclose a habitat unit (e.g., a pool or riffle) to prevent fish from escaping the site. Employ two fishing trials per site. If no fish are captured in the first trial, a second trial might succeed. Fish are often easily caught in the second pass if the stream becomes cloudy and disorients the fish due to reduced visibility. Some fishes such as young coho salmon are attracted to suspended sediments because invertebrate prey is also stirred up from the steam bottom by the first seining effort.

Baited Gee-type traps (commonly known as minnow or fry traps) will not catch fish too large to enter the trap but will catch fry, parr, smolts and other juvenile fishes easily.

1. To use the trap, open it, put in some bait (e.g., salted fish roe or pierced cans of either shrimp or sardines), add a small rock for ballast, and close the trap.
2. Attach a long tether string and drop the trap into the stream. Make sure the trap is in water deep enough to be sufficiently submerged. Tie off the tether string so that the trap is secured to the stream bank, and mark the site with a piece of high-visibility flagging tape. Take care to select locations where trap recovery will be easy.
3. Gee traps work well in stream pools or in the quieter water downstream of boulders or debris, but tend to roll around too much if placed in a fast current, and therefore, will not fish effectively. If possible, orient the trap lengthwise into the flow (the apertures will then be in line with the flow).

Gee traps should be set during daylight hours on one day and ideally left to fish overnight at minimum, preferably for 24 h. This requirement may be logistically difficult when crews are attempting to cover many reaches in the quickest possible time. However, try to set traps so that fishing occurs during a period including either dawn or dusk. Fish are usually the most active at these times. In most cases, fish are caught within a few hours after the traps have been set.

If this method is employed, sufficient traps should be obtained to cover a significant part of a stream reach. Trap number and spacing will depend upon professional judgment. As a guide, try to achieve a trapping density of at least one trap per 10 lineal metres of stream, or place traps in the following key sites, especially when the features occur within high-slope reaches containing fast-flowing water and stepped pools. These features represent prime habitats for stream fishes: •

- main channel pools, especially those on the downstream edge of large boulders or those downstream of stable, large woody debris •
- off-channel pools near woody debris or overhanging banks •
- logjam pools •
- undercut banks •
- riffle-pool junctions, especially under the cover of banks.

Observe the pools for awhile to see if there are larger fish present that are too big to enter the traps. Also check the stream margins for the presence of small fry because these sites are too shallow to be fished effectively with Gee traps.

Be sure to make every reasonable effort to recover all traps because they will continue to catch fish if they are not taken out of the stream. If any trap cannot be recovered, the trap location and reasons why recovery was not possible should be reported.

Electrofishing is a relatively complex procedure that requires training and technical certification to high standards by the Workers' Compensation Board. This procedure is not discussed in detail here. (See the RIC inventory manual *Fish Collection Methods and Standards*, Version 4.0) The same key habitats discussed under fish trapping should be covered when electrofishing is undertaken. Electrofishing is advantageous because entire stream reaches can usually be covered relatively quickly within one day. Unlike trapping, no overnight or sampling is required. Use a small barrier net when electrofishing in streams, especially fast-flowing ones. Place the net just downstream of the riffle or pool being sampled so that any shocked fish collect against the net. In some steep stream reaches, shocked fish may be difficult to detect at the site where the probe is used because of turbulent water. The effectiveness of electrofishing varies not only with environmental conditions and the species and size of fish, but also with the voltage, electric pulse frequency, and the experience of the electrofishing operator. If a single fishing trial fails to capture any fish, consider adjusting the frequency or voltage settings for a second trial.

Survey Timing

Fisheries resource agencies usually sample for fish during mid-summer periods of low flows (July–August). This period is also recommended for surveys of fish presence or absence because (a) low flows may concentrate fish in stream pools at this time, and (b) juveniles of most species will be present in streams, lakes and wetlands. Exceptions in coastal streams include the fry of pink and chum salmon. These fry migrate downstream almost immediately after they emerge from the stream gravels in spring. However, both pink and chum occur most frequently in relatively low slope reaches where the probability of anadromous and game fish presence is very high.

If seasonally flooded channels, wetlands, and other off-channel sites are to be confirmed for fish absence, an additional survey will be required (a) for the fall or spring in interior watersheds when water bodies are free of ice but contain seasonally elevated volumes, and (b) in the fall or winter in coastal drainages. Channels that are dry during summer, but flooded at these other times of the year, are potential fish habitats if the adjacent main channel contains fish. These sites must be checked at the times noted here for extent and duration of flooding, fish access and fish presence or absence.

Acceptable Survey Methods

The two alternative procedures detailed below will satisfy the requirements for an acceptable fish inventory as legally referenced in paragraph (b) of the fish-bearing definition.

For sampling stream reaches and off-channel sites to determine fish presence or absence, it is recommended that sampling be done in a systematic and repeatable manner. Be sure to cover the best of the available habitat within a stream reach. Studies have shown that to establish the presence of certain species such as bull trout in some high-slope, high-elevation reaches, as much as 1.2 km of stream coverage is necessary. Because of this pattern of distribution, the recommended sampling method for fish-bearing identification has required the coverage of as much as 500 m to 1 km of stream to confirm the absence of species such as bull trout. This procedure, which involves fishing until the first caught is retained, is one of two alternate survey methods recommended for fish-stream identification.

To reduce the costs and simplify the logistics associated with the **"first-fish captured"** method, an alternative **"systematic-sample method"** is recommended that involves sampling the entire length of a representative portion of a stream reach. This portion surveyed will be 100 m long or have a length equivalent to 10 bankfull channel widths (whichever is greater). The entire length of the selected segment does not have to be sampled if fish are captured in abundance, even within the first few metres of coverage (see below).

The systematic-sample method offers important advantages. First, the total length of stream that needs to be covered within each survey will be substantially reduced in most cases. For example, the results of a single-trial systematic survey performed competently in the sample site will be acceptable if:

1. the sample site selected represents the available habitat in the reach
2. the site is sampled thoroughly at the right time of year by using gear suitable for the season, habitat, species and life stage
3. observations on habitat quality and accessibility to fish support the fish survey results.

Second, the results of the systematic survey generate useful data on the **probabilities** of fish presence or absence in streams of given size, slope and location within a watershed. These data can be added to the base of knowledge from reconnaissance fish and fish habitat inventories. Systematic-survey results are even more important in areas where no reconnaissance inventories are available. Information accumulated from systematic surveys can be used to predict the likelihood of fish presence in similar streams in unsurveyed areas of a watershed.

Regardless of the method adopted, the first step is to determine the likelihood of fish presence from a review of the existing knowledge on fish distribution for the specific areas to be affected by development. If no information is available, then fish surveys must be conducted in reaches < 20% slope to confirm fish absence.

When known information is reviewed, look for information on the potential occurrence of bull trout or other very rare (i.e., low density) fish for the sites that will be sampled. Fish are more difficult to detect if they are at very low population densities. If the data

review suggests this is probable, a more rigorous sampling intensity is justified (see step 5 in the systematic method below).

One of the two sequences detailed below may be employed in the season most appropriate for fish presence considering the type of available habitat, species and life stage.

Option 1: Systematic-Sample Method

1. The first site recommended to be sampled is a representative length within the uppermost reach included in the affected area. Fish distributions downstream of the reach, taking barriers and other features into account, can be assumed from the results of this survey.
2. The length of the selected site will be equal to 10 bankfull channel widths, or 100 lineal metres (whichever is greater). The entire length of the site is sampled for fish. Sampling must systematically cover all available habitat types and employ techniques appropriate to the anticipated species and habitats present. Use the technique most appropriate for the season and physical conditions.

   If no fish are caught in the first trial, but there are doubts about sampling efficiency, sample again with a second method. Sampling methods and results are recorded on the standard fish collection forms.

   If electrofishing is employed and fish are caught in abundance, even within the first few metres of coverage, stop sampling. For example, if 10 to 20 specimens are captured within the first 5 to 10 metres, the reach clearly supports fish in abundance.
3. If no fish are captured in the initial sample site, the biologist or field technician must make a professional judgment as to whether and how much further fish sampling should be conducted.

   If sampling at a different time of year is warranted due to water temperatures that are too low, or ephemeral habitats that are accessible to fish are present but dry, sampling should be terminated in favor of a follow-up survey at a more appropriate time.
4. Sampling is finished when the surveyor is confident that there is enough evidence to support the conclusion that no fish inhabit the reach. If the evidence to support fish absence is insufficient, then further sampling is required.
5. If no fish are found in the initial sample site, but habitat quality appears good and no barriers to fish access are evident, a second site of a length equal to the first site must be sampled within the same reach, again covering all habitat types. The most appropriate sampling method shall be employed. Sampling methods and results are recorded on the fish collection forms found in the FLNRORD Fish Stream Identification Guidebook.
6. In cases where it has been previously determined that populations of fish occur in the area at very low densities, and if no fish have been captured in the initial sampling site, additional sampling is recommended. Consult with a local ministry representative prior to initiating surveys. It is expected that these situations will be

relatively uncommon; however, sampling the remainder of the reach might be recommended for reaches < 500 m long. Sampling methods and results are recorded on the standard fish collection forms.

7. Evidence for justification of a non-fish bearing stream reach is reported as a "non-fish-bearing status report" as outlined below. This may include results of any 1:20 000 reconnaissance fish and fish habitat inventory previously conducted in the watershed.

Option 2: First-Fish-Captured Method

1. To sample for fish, begin at the downstream end of the reach and proceed sequentially upstream until a fish is caught and identified as one of the species of concern.
2. If no fish are caught, continue upstream and cover the entire length of reaches up to 500 m long. For reaches 1 km long or longer, surveys focused on the deepest pools and other key habitats noted above are recommended for an additional 500 m. Be sure to cover the available habitat. Studies have shown that to establish the presence of bull trout in some high-slope, high-elevation reaches, as much as 1.2 km of stream coverage is necessary. In order to establish absence, sampling according to the procedures of this guidebook must be thorough enough to produce reliable results that minimize the likelihood of error.
3. Document sampling methods and results on the recommended fish collection form (see 5. above).
4. Evidence for justification of a non-fish bearing stream reach is reported as a "non-fish-bearing status report."

Non-Fish-Bearing Status Report

All stream reaches for which non-fish-bearing status is proposed require a short, concise, written justification for this designation. This non-fish-bearing status report contains information that, in the professional opinion of the person responsible for the survey, provides sufficient evidence to support the conclusion that fish do not occur in the stream reach in question. Information that should be provided includes:

1. date and time of sampling events, including initial and any follow-up sampling efforts;
2. fish sampling methods and effort employed:
   - capture methods used (e.g., electrofisher; Gee traps; use of barrier nets at either downstream limit, upstream limit, or at both ends of the sampled site)
   - sampling area covered (number, length and area of sample site)
   - sampling effort (e.g., number of traps, electrofishing seconds)
3. stream conditions during sampling (e.g., specific conductance; flow stage of high, medium or low; temperature; turbidity)
4. supporting evidence:

- known fish species presence both upstream and downstream
- type and location of obstructions to fish migrations
- seasonal habitat availability
- seasonal fish use of stream and off-channel habitats
- results of any 1:20 000 reconnaissance fish and fish habitat inventory conducted in the watershed.