APPENDIX E – Fish Sampling Methodology

The following is excerpted from the Riparian Areas Regulation Assessment Methods (2006) (http://www.env.gov.bc.ca/habitat/fish_protection_act/riparian/documents/assessment_methods.pdf), and describes the methodology required in order to state that fish are absent from a given watercourse.

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 this guidebook.

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 OF ENVIRONMENT regional offices and FISHERIES AND OCEANS CANADA 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 Ministry of Forests Fish Stream Identification Guidebook:
   www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/FISH/FishStream.pdf

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 the local MINISTRY OF ENVIRONMENT 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.